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Assessment of Knowledge, Belief, and Practices Regarding Cirrhosis among the Students of the University of Lahore

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ABSTRACT: Cirrhosis is a liver injury, which leads to portal hypertension, hepatic encephalopathy, ascites, and end-stage liver disease. The study aimed to explore how much students know about liver cirrhosis and its complexity. The cross-sectional study was conducted on university students in the year 2020. A self-structured questionnaire was used in this study. It was divided into three portions, i.e., knowledge-related questions, belief-related questions and practice-related questions. Fifty-eight students participated in this study. 34.3% of students knew about the term cirrhosis, 55.2% knew about the causes of cirrhosis, 7.1% were not aware of its complications, 62.1% of students knew that dysphagia is the leading cause of malnutrition in cirrhosis, and 44.8% knew that hepatic encephalopathy leads to coma. Additionally, 46.6% believed that end-stage liver disease and cirrhosis are the same, and 77.6% believed that jaundice leads to liver disease. Furthermore, 36.2% had previously participated in a nutrition education program related to hepatic diseases, and 24.1% recommended Child-Pugh score to cirrhotic patients to assess liver function. Conclusively, some students had necessary information on liver cirrhosis, whereas some did not know about it. Moreover, the practices of the students were not according to the knowledge they had. As a health professional, the students who do not know cirrhosis well will inefficiently deal with the patients suffering from cirrhosis.

Keywords: Cirrhosis, knowledge, belief, practices, assessment

INTRODUCTION

Liver is the human body's largest gland which plays a vital role in the metabolism of basic nutrients such as protein, carbohydrates and fat (Nishikawa et al., 2015). While, cirrhosis is a liver disease in which normal tissues are replaced by scar tissues and damage to liver is not recoverable (Ge et al., 2016). Cirrhosis reduced the metabolism of the nutrients and effects the normal working of the body.

Now a days it is primary goal to treat cirrhotic patients with diet and adequate nutrients. It is reported that diet serves as long-term nutrition support for cirrhotic patients as it provides enough energy and protein naturally. A study regarding this disease supported that eating 4 to 7 small meals compared to 3 big meals with the addition of 1 late evening carbohydrate snack is considered useful in improving nitrogen economy in cirrhotic patients (Sidiq and Khan, 2015).

According to Global burden on disease, cirrhosis results in more than 1.32 million deaths globally in 2017 representing that 11.4% increase since 2012 (Paik et al., 2020). It includes 440 000 deaths in females and 883 000 deaths in males as compared to death

rate of 1990 when there is only 899 000 deaths for both sexes. The prevalence of decompensated cirrhosis is 10.6 million in 2017, of which 6.42 million are males and 4.23 million are females. It is noticed survival chances of patients with decompensated cirrhosis are approximately 2.5 years. (Zipprich et al., 2012). In the case of compensated cirrhosis, the prevalence rate is 112 million of which there are 66.1 million males and 46.3 million females. At the regional level, central Asia has the highest death rate due to cirrhosis (Sepanlou et al., 2020). In Pakistan, HCV has been documented as the highest cause of cirrhosis making Pakistan the second most prevalent country. Presently, Pakistan has almost 10 million patients affected with HCV and are at risk of developing cirrhosis (Ullah et al., 2020). In 2013, 7 million people were affected with HCV, which showed that Pakistan has one-tenth of the global burden of HCV (Lim et al., 2018).

One of the most common causes of increased disease and death rates in developed countries is cirrhosis. In adults, it is the 14th and in central Europe, it is the 4th dominant element of death. The prevalence is more in developed countries due to the infection

with hepatitis C virus, alcohol misuse, and, increasingly, non-alcoholic liver disease; in sub-Saharan Africa and most parts of Asia, hepatitis B virus infection is the most common. Cirrhosis is referred to as ESLD that leads to necroinflammation and fibrogenesis as a result of liver injury. If transplantation is not done, it leads to death (Harrison et al., 2015). When liver damage progresses, the disease proceeds to be decompensated cirrhosis that is end-stage liver disease. According to global estimates, the mortality rate in 2012 is more than one million due to this liver disease (Peng et al., 2019)

A decrease in the frequency of hepatitis C virus (HCV) infection is a significant cause of cirrhosis (Yoshida et al., 2015). Infection occurs through hepatitis B, and hepatitis C virus is the major source of the development of hepatocellular carcinoma. It is the most common form of liver cancer and contributes to 90% of cases. Hepatitis B virus infection is the most common factor for the development of HCC; it accounts for 50% of cases (Llovet et al., 2021). People having hepatitis C virus infection had a chance of 20 to 30% of developing liver cirrhosis (LC) or hepatocellular carcinoma (HCC) (Imai et al., 2010).

Cirrhosis is considered as one of the silent and asymptomatic diseases as far as it increases the portal pressure and damages the liver. The asymptomatic phase of cirrhosis is also known as compensated cirrhosis, in which no symptoms occur, the disease is undetectable, and the patient has a good quality of life. While on the other side, decompensation is the occurrence of ascites, bleeding, encephalopathy and jaundice. The beneficial effects of Long-term oral BCAA supplementation are: it increases serum albumin levels, and in decompensated cirrhotic patients with hypoalbuminemia (serum albumin level of 3.5 g/dl or lower) improves QOL, whereas BCAA granules show no effect on serum albumin levels in patients with compensated cirrhosis (serum albumin level 3.6-4.5 g/dl) (Fukui et al., 2016).

Liver Cirrhosis (LC) not only affects the liver but also causes many other diseases such as PEM and poor physical health in which a patient loses his/her muscle volume and experience muscle weakness. This condition is known as sarcopenia (Toshikunet al., 2014). Patients with LC must have edema because of fluid retention due to excess drinking. Around 60% of renal sodium retention is present in patients with LC (Tsochatziset al., 2014). In

order to treat these patients improvement of edema is a major therapeutic strategy. Spironolactone which is an aldosterone antagonist either used alone or in combination with diuretics that are furosemide is considered as the main treatment for patients with liver cirrhosis and edema (Sakaida et al., 2020).

In cirrhotic patients, malnutrition increases the risk of mortality and morbidity. The purpose of the current study was to assess the knowledge, belief, and practices about cirrhosis among university students. The study was done to assess the efficiency of students in the clinical field. This study would encourage the students in better learning regarding cirrhosis and to improve the knowledge.

MATERIALS AND METHODS

A cross-sectional study was done at The University of Lahore in 2020. Fifty-eight students participated in this study that was selected through cluster sampling technique. It includes both male and female students. A self-structured questionnaire was used for data collection regarding knowledge, belief, and practices related to cirrhosis and its complications. These questionnaires were filled by students. The first section of the questionnaire was prepared with nine general

questions; the second part consist of four items that are related to the knowledge complications of cirrhosis. The third section of the questionnaire was based on the student's belief of complications of cirrhosis and it has 2 questions that were made to assess the practical application. These questions were close-ended, so only two options were given to students i.e. yes and no. Data were analyzed with the help of SPSS version 20.0. The variables were reported using percentages and frequencies. The rules and regulations were set by the ethical committee of The University of Lahore. The rights of the research participants were respected. All data were kept confidential. Participants remained anonymous throughout the study.

RESULTS

It was noticed that 48 (82.8%) students were aware of the term cirrhosis while, 10 (17.2%) were unaware. 32 (55.2%) knew about the causes of cirrhosis, while 26 (44.8%) were unaware. 43 (74.1%) subjects heard about 'end-stage liver disease, while 15 (25.9%) did not. 45 (77.6%) students did not know that cirrhotic patients' assessment of liver function is determined by Child-Pugh score, while only 13 (22.4%) knew. 50 (86.2%) of the participants were aware that smoking can enhance the risk of liver

damage, while 8 (13.8%) did not. 52 (89.7%) participants agreed that hepatitis could be transmitted by unsterilized syringes, needles and surgical instruments, while 6 (10.3%) denied it. 36 (62.1%) had heard cirrhotic patients

have poor oral health than others, while 22 (37.9%) did not. 35 (60.3%) knew that viral hepatitis is the most common cause of cirrhosis, while 23 (39.7%) did not (Table 1).

Table 1: Frequency distribution of knowledge about general questions

Sr. No.	Questions	n (%)	
		Yes	No
1	Are you familiar with the term 'cirrhosis'?	48 (82.8%)	10 (17.2%)
2	Do you know the causes of cirrhosis?	32 (55.2%)	26 (44.8%)
3	Have you heard about 'end-stage liver disease (ESLD)?	43 (74.1%)	15 (25.9%)
4	Does cirrhotic patient's assessment of liver function determined by Child-Pugh score?	13 (22.4%)	45 (77.6%)
5	Is smoking increasing the risk of liver damage?	50 (86.2%)	8 (13.8%)
6	Have you heard cirrhotic patients have poor oral health than others?	36 (62.1%)	22 (37.9%)
7	Is viral hepatitis is the most common cause of cirrhosis?	35 (60.3%)	23 (39.7%)
8	Is there any vaccine for liver diseases?	27 (46.6%)	31 (53.4%)
9	Can hepatitis be transmitted by unsterilized syringes, needles and surgical instruments?	52 (89.7%)	6 (10.3%)

It was noticed that 36 (62.1%) students knew that dysphagia is the leading cause of malnutrition in cirrhosis, while 22 (37.9%) did not. Similarly, 35 (60.3%) knew that low physical activity levels are inversely associated with insulin resistance in liver cirrhosis patients, while 23 (39.7%) did not. 15 (25.9%) heard that spontaneous bacterial peritonitis occurs 10-30% in patients with cirrhosis, while 43 (74.1%) did not. Moreover, 26 (44.8%) knew that hepatic encephalopathy leads to coma, while 32 (55.2%) did not (Table 2).

Table 2: Frequency distribution of knowledge about complications

Sr. No.	Questions	n (%)	
		Yes	No
1	Is dysphagia the leading cause of malnutrition in cirrhosis?	36 (62.1%)	22 (37.9%)
2	Do low levels of physical activity are inversely associated with insulin resistance in liver cirrhosis patients?	35 (60.3%)	23 (39.7%)
3	Have you heard that Spontaneous bacterial peritonitis occurs 10-30% in patients with cirrhosis?	15 (25.9%)	43 (74.1%)
4	Can hepatic encephalopathy lead to a coma?	26 (44.8%)	32 (55.2%)

According to frequency distribution of belief about complications it was seen that 27 (46.6%) participants believed that end-stage liver disease and cirrhosis were the same, while 31 (53.4%) did not. 45 (77.6%) believed that jaundice leads to liver disease, while 13 (22.4%) did not. 42 (72.4%) believed that hepatitis is a communicable disease, while 16 (27.6%) did not. 31 (53.4%) believed that hepatitis B is more severe than hepatitis C, while 27 (46.6%) did not (Table 3).

Table 3: Frequency distribution of belief about complications

Sr No.	Questions Cirrhosis	n (%)	
		Yes	No
1	Do you think End-stage liver disease and cirrhosis are the same?	27 (46.6%)	31 (53.4%)
2	Do you think jaundice leads to liver disease?	45 (77.6%)	13 (22.4%)
3	Do you think hepatitis is a communicable disease?	42 (72.4%)	16 (27.6%)
4	Do you think hepatitis B is more severe than hepatitis C?	31 (53.4%)	27 (46.6%)

It was noticed in frequency distribution of practice about complications 21 (36.2%) participated in a nutrition education program related to hepatic diseases, while 37 (63.8%)

did not. 14 (24.1%) recommended Child-Pugh score to cirrhotic patients to assess liver function, while 44 (75.9%) did not (Table 4).

Table 4: Frequency distribution of practice about complications

Sr. No.	Questions Cirrhosis	n (%)	
		Yes (n%)	No (n%)
1	Have you ever participated in a nutrition education program related to hepatic diseases?	21 (36.2%)	37 (63.8%)
2	Do you recommend child-Pugh score to cirrhotic patients for the assessment of liver function?	14 (24.1%)	44 (75.9%)

DISCUSSION

The study was conducted to assess the knowledge, belief and practices regarding cirrhosis and its complications among university students. The current study showed that 82.8% of students

were familiar with the term cirrhosis, and 17.2% were not aware of it. A similar study was conducted by Zhang et al. (2019) in which it was assessed how much cirrhosis patients know about their disease on hospital admission. The results were average on admission but

on hospital discharge patients were well aware of the disease, prevention, management and medication. Another study was conducted on hepatocellular carcinoma surveillance by Beg et al. (2016). In this study leaflets given to patients before general consultation, 26% of patients showed improvement in an understanding modification in their lifestyle. This study showed that patients lack basic knowledge on the diagnosis of cirrhosis.

Moreover, the current study showed that 55.2% of students knew the causes of cirrhosis, and 44.8% were unaware of it. On the other hand, 46.6% of students knew the difference between end-stage liver disease and cirrhosis, while 53.1% did not know. A survey conducted by Ramachandran et al. (2020) assessed the knowledge of self-management on 150 patients in which 53% answered correctly. This percentage increased upto 67% after intervention through an educational booklet. Hayward et al. (2017) studied patients with decompensated cirrhosis on their medication knowledge. Medication variation was seen in 50% of ambulatory patients with a low literacy rate. The main barrier to this study was health knowledge that most cirrhosis patients lack. Study results showed that clinical pharmacist

education provides sufficient knowledge for future management of these patients.

Additionally, another study was done on liver cirrhosis in which Alzahrani et al. (2018) reported that the knowledge of liver cirrhosis among Saudi people was good. They were well aware of the risk factors and hepatitis virus that cause liver cirrhosis but they were average in prevention, intervention and treatment. Thus, most of the Saudi population was not aware of the consequences and management of liver cirrhosis. Saleh et al. (2021) conducted a qualitative study which showed that patients with cirrhosis face a large number of barriers in managing their disease. This is due to lack of their understanding about the mechanism of disease and its progression.

In the present study, students were asked whether they participated in any program on hepatic diseases. 36.2% had participated in any of the activities related to hepatic diseases whereas 63.8% of students never attended any program related to hepatic disease. In a similar study by Trinh (2019), although the outcomes demonstrated that patients had a more significant level of the necessary information on cirrhosis than in previous investigations among liver cirrhosis patients, still everything needed significant knowledge about

self-administration of their disease. This lack of understanding might be represent an impediment to the social insurance of suppliers who are attempting to help patients. Furthermore, the current study results showed that 62.1% of students knew about dysphagia regarding cirrhosis, whereas 37.9% were not well aware of it. A similar study conducted by Caber et al. (2014), showed that 61.9% of women aged 84.9 years were enrolled for 24 months. In 47.5% of cases, it was determined that patients had dysphagia. Out of these individuals, 24.2% had aspiration pneumonia. The hospital readmission rate for pneumonia in individuals without dysphagia was 3.67 per 100 people per year, whereas the rate for patients with dysphagia was 6.7 per 100 people per year. A similar study conducted by Rogal et al. (2020) showed that disease knowledge in 52 patients in tertiary care centers was poor. The baseline score of their knowledge was 21% which improved to 60% after the intervention phase through multimedia presentations. One more study conducted on liver cirrhosis in which Aberg et al. (2020) showed that patients with liver fibrosis have reportedly low to moderate consumption of alcohol and a high risk of hepatocellular carcinoma and death due

to liver disease. In this study's results, 79.9% of students have heard about the term end-stage liver disease, whereas 20.1% lack this knowledge. On the other hand, 46.6% of students thought that there is no difference between ESLD and cirrhosis; however, 53.4 % thought that there is a difference between these two terms. A study conducted by Sharma et al. (2021) showed that patients with decompensated cirrhosis undergo decreased quality of life however they felt supported by their caregiver, as the caregiver does not express their emotions during the first post-discharge visit. Another study conducted by Sprange et al. (2020) showed that ninety-seven patients were included. The mean model for end-stage liver disease was 12. Although 97% of patients indicated, it was crucial to know the reality of their illness, only 53% understood that cirrhosis would affect their future quality of life. A study conducted by Ramachandran et al. (2020) showed that 10% of patients with compensated cirrhosis develop ascites. Self-management of ascites can be facilitated by knowing the symptoms of ascites.

The results of the present study showed that 86.2% of students were well aware of bad effects of smoking on the liver, how it enhances its

complications, while on the other hand, 13.8% were unaware of it. Likewise, in a study, Dam et al. (2013) showed that many members were smokers in this investigation. Subsequently, 61% were current smokers at their first admission in the CCHS, and it was found that roughly 26% and 8% of cases of alcoholic liver cirrhosis could be ascribed to smoking in this study among ladies and men, individually. For liver cirrhosis, around 12% of cases for ladies and 6% of cases for men could be attributed to smoking. In the present study, according to 89.7% of students, hepatitis can be transmitted by unsterilized syringes, needles and surgical instruments but 10.3% did not agree with that. Similarly, a study by Reanget al. (2015) was conducted on males and females of age 21.52 and 20.90 years. 99.7% of members knew that hepatitis B is an infection. 92.7% said that hepatitis B is contagious and 63.1% of them knew that hepatitis B transmission could occur through risky sex, infected blood/body fluid contaminated syringe, needle and surgical tools. 84.7% of respondents were vaccinated with three portions of hepatitis B antibody.

CONCLUSION

It was concluded that the majority of the students knew about liver cirrhosis, however, their practices were

not according to their knowledge. The students who did not have enough awareness regarding cirrhosis will have inefficient dealings with the patients suffering from cirrhosis. In the future, if these concerns are not well-addressed among the health professionals during their learning and training period, the community will suffer.

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Conflict of interest

There is no conflict of interest

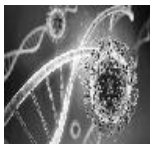
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Prevalence of Diabetes and Hypertension in Youngfemales of Lahore College for Women University, Lahore

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ABSTRACT: *Diabetes and hypertension are non-communicable diseases. Diabetes is a significant cause of early death and debility globally. The objective of the present study is to find out the percentage incidence of diabetes and hypertension in young females of Lahore College for Women University Jail Road, Lahore. This cross-sectional study was conducted, January 2017 to June 2017. It was included 200 subjects. The average age of the population under study was 20 ± 0.17 years. About 4.5% (n=9) of the population was pre-diabetic and all were obese. While, 36% (n=73) of population was suffering from prehypertension and 5% (n=10) with hypertension. Among a total of 83 subjects with elevated systolic blood pressure (SBP), 41 were overweight and obese. According to diastolic blood pressure (DBP) 7% (n=14) of the population was suffering from pre-hypertension and 6% (n=12) with hypertension. 26 subjects had elevated diastolic blood pressure and among these, 20 subjects were overweight and obese. The whole population is divided among 4 groups according to the age groups. Body mass index was more prevalent in the age group 25-27 years. It is stated that overweight and obesity are strongly associated with diabetes and hypertension. It was concluded that increased BMI was the main predictor of diabetes and hypertension. However no diabetic patient were found in population and the prevalence of pre-diabetic subjects were 4.5 % and according to SBP and DBP 5% and 6 % of the population were hypertensive.*

Keyword: *hypertension, diabetes, pre-diabetes, prehypertension, women's health*

INTRODUCTION

Diabetes mellitus is a metabolic disorder. It is a bunch of illnesses

characterized by an unusual carbohydrate digestion system that leads to hyperglycemia. It is related to a comparative or supreme lack of insulin

secretion or resistance to the activity of insulin (Ogedengbe, 2009). In 2012 there were 1.5 million people around the world specifically effected by diabetes. It was the eighth driving cause of passing among both genders and the fifth driving cause of passing in ladies in 2012 (WHO, 2016)

Much of this increase will happen in developing nations and will result from populace age, unhealthy food intake, weight gain and inactive life style. The prevalence of diabetes, comprised primarily by type 2 diabetes (T2D), is a global public health danger. The prevalence among grown-ups matured 20-70 years is relied to rise from 285 million in 2010 to 438 million by the year 2030. The prevalence of diabetes is increasing in Asian countries as Asian countries contribute to more than 60% of the world's diabetic population (Ramachandran et al., 2012).

Type1 diabetes accounts for as it were 5-10% of all diabetes cases. Its frequency proceeds to extend around the world. Type 2 diabetes, termed as non-insulin-dependent diabetes mellitus or adult-onset diabetes, may account for around 90% of all analyzed cases of the infection. Impaired glucose tolerance (IGT) and impaired fasting glycemia (IFG) are middle conditions within the move between ordinary blood glucose

level and diabetes (particularly type 2), even though the move isn't unavoidable. Individuals with IGT or IFG are at expanded hazard of heart assault and strokes (Shaw et al., 2010). Gestational diabetes (GDM) may be a short-lived condition that happens in pregnancy and carries the long-term hazard of type 2 diabetes (Bellamy et al., 2009).

Type 1 is caused by the interaction between hereditary material and environmental factors. Mostly occurs in children and young people. The chance of type 2 diabetes is decided by a transaction of hereditary and metabolic variables. Ethnicity, family history of diabetes, and past gestational diabetes combine with more seasoned age, physical dormancy, undesirable count calories, obesity and smoking to extend risk. Overweight and corpulence, at the side of physical dormancy, are evaluated to cause a huge extent of the worldwide diabetes burden (Forouzanfar et al., 2015). Chance variables and chance markers for GDM incorporate age, overweight or obesity; over the top weight pick up amid pregnancy and family history of diabetes (Anna et al., 2005).

1.9% of direct or extreme visual impedance universally and 2.6% of visual deficiency in 2010 is caused by diabetic retinopathy (Bourne et al.,

2013). Considers propose that predominance of any retinopathy in people with diabetes is 35% where as proliferative (vision-threatening) retinopathy is 7%. Be that as it may, retinopathy rates are higher among: individuals with type 1 diabetes; individuals with a longer length of diabetes; Caucasian populaces; and conceivably among individuals of lower socioeconomic status. (Yau et al., 2013). Grown-ups with diabetes verifiably have a two or three times higher rate of cardiovascular disease (CVD) than grown-ups without diabetes. Diabetes shows up to drastically increment the chance of lower extremity amputation. Hypertension, also known as high blood pressure, is a long term medical condition in which the blood pressure in the arteries is persistently elevated.

There are approximately 1.5 billion individuals with raised BP all inclusive. It is evaluated to cause 7.1 million passing within the world (13% of the overall) each year and approximately 4.4% of the worldwide illness burden. Within the Joined together States, each year hypertension accounts for 35% of all myocardial areas of dead tissue and strokes, 49% of all heart disappointment and 24% of all untimely deaths. Hypertension, being a silent disease, often goes undiagnosed leading to

serious complications which include strokes, heart attacks/heart failure, visual loss and kidney failure (Forouzanfar et al., 2016).

Diabetes is multifactorial disease and hypertension is itself a leading cause of a lot of cardiovascular disease. It's an important study and the main objective of the study is to find out the percentage incidence of diabetes and hypertension in young females of Lahore College for Women University Jail Road, Lahore.

MATERIALS AND METHODS

The design of the study was cross-section, January 2017 to June 2017, at Lahore College for Women University Jail Road, Lahore. 200 subjects were included in this survey. The study was approved from the ethical committee of Zoology Department of Lahore College of Woman University, Lahore. Their Demographic data, socioeconomic status, family history of diabetes and hypertension and lifestyle were recorded through a comprehensively designed questionnaire.

Standing height was measured using the height measuring tape in the feet. With the participant's feet put at the side heels, buttocks and shoulder blades against the adhere and head situated within the Frankfurt even plane. Height is initially measured in

centimeters then converted into meters. Weight was measured by using Weighing Scale with a subject standing erect without shoes. Glucometer was used to measure the blood sugar level. The blood sugar levels were recorded randomly. The standard method of measuring blood pressure is the indirect method called the auscultatory method. After measuring height and weight, BMI (kg/m^2) was calculated by using a formula for BMI (kg/m^2).

Formula used for calculating BMI (kg/m^2) was:

$$\text{BMI kg/m}^2 = \frac{\text{Weight in kilograms}}{\text{Height in meter}^2}$$

Statistical Analysis

Data were analysed statistically and were presented in the form of graphs, charts and tables. Microsoft Office Excel 2013 was used for statistical analysis. Mean values of parameters were calculated and expressed as \pm SEM. Analysis of variance (ANOVA) was used to evaluate differences in anthropometric variable means according to blood sugar level. p -value was considered significant at 0.05 or less. A computer program SPSS 16.0 was used for the analysis of *Pearson's* correlation between blood sugar level and blood pressure and body mass index (BMI).

RESULTS

In studied population the mean age was 20.41 ± 0.17 years. The demographic data was presented in Table 1.

The total population was divided into 4 groups based on age. Group 1 has subjects of age range 16-18 years. The age range of group 2 was 19-21 years, the age range of group 3 was 22-24 years and the age range of group 4 was 25-27 years. The average values of age, height, weight, systolic blood pressure, diastolic blood pressure, sugar level and BMI were calculated in all age groups. BMI was more prevalent in the age group 25-27 years. One-way ANOVA was applied revealed significant difference of BMI but in systolic blood pressure, diastolic blood pressure and sugar level groups' difference was non-significant.

In the study particularly those subjects were included who had a fasting of about 10-16 hours when their blood glucose level was examined. It was observed that out of 200 females, 9 were pre-diabetic and 191 were normal. There was no diabetic subject in the studied population.

The atrial blood pressure was divided into two sub-groups. The systolic and diastolic blood pressure of the population was separated. According

to systolic blood pressure, 36% (n=73) of the population was suffering from pre-hypertension and 5% (n=10) with hypertension. According to diastolic blood pressure, 7% (n=14) of the population was suffering from pre-hypertension and 6% (12) with hypertension. 43.5% (n=87) of population under study was suffering from pre-hypertension state and 11% (n=26) with hypertension.

According to the Asian criteria, 13% (n=26) of studied population was underweight, 51% (n=103) normal, 15% (n=15) overweight, and 16% (n=16) obese. 4% (n=8) population belonged to

obese class I and only 1% (n=1) to obese class II. There were 9 pre-diabetes in this study and all were obese. The number of subjects who had elevated systolic blood pressure was 83. Among 83 subjects 41 were overweight and obese. 20 subjects out of 26 were overweight and obese whose diastolic blood pressures were elevated.

To determine the impact of BMI on blood sugar level the correlation analysis was done which revealed that blood sugar level was correlated with BMI ($r = 0.204$) whereas the correlation of blood pressure with BMI is non-significant. (Fig. 1)

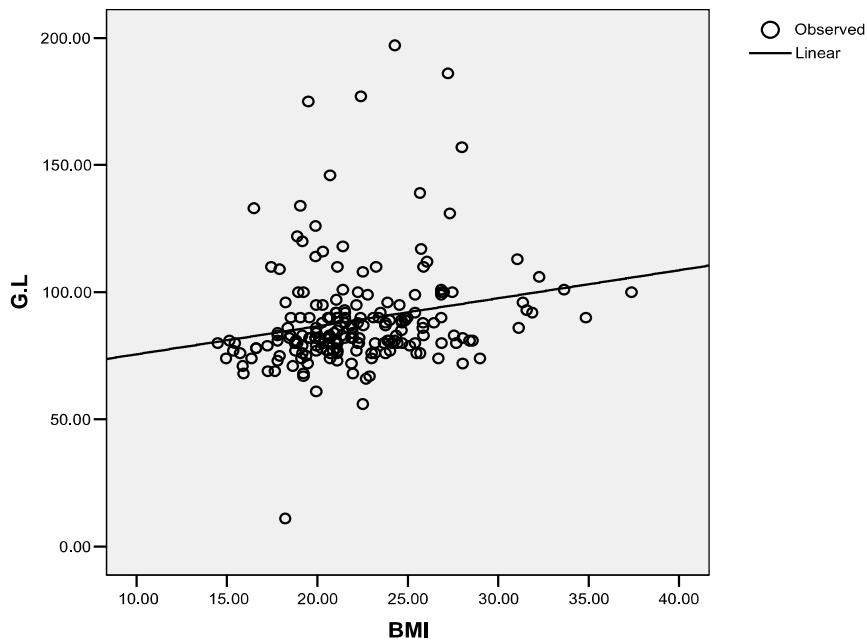


Fig. 1. Correlation between BMI (Kg/m^2) and Glycemic level (g/dL).

Table 1: Demographic Data of Studied Population

Sr. No.	Variables	Mean \pm S.E.M
1	Age	20.41 \pm .17
2	Height (cm)	159.9 \pm .5
3	Weight (kg)	56 \pm .6
4	BMI (kg/m ²)	22.17 \pm .27
5	Systolic blood pressure (mm/Hg)	119.4 \pm .17
6	Diastolic blood pressure (mm/Hg)	79.45 \pm .35
7	Sugar level (g/dL)	89.01 \pm 1.5

DISCUSSION

Type 2 diabetes is getting to be a progressively predominant clutter among youthful people who are driven, as is the case in grown-ups, by way of life variables driving to expanded body weight. Hereditary and familial components, fetal natural variables, especially maternal gestational diabetes and intrauterine development hindrance, and the need for physical action amid childhood and puberty lead to expanding levels of insulin resistance that show up to be vital within the pathogenesis of type 2 diabetes within the youthful. The disorder is associated with microvascular malady, with a proposal of a more prominent risk of nephropathy than of retinopathy, and may too lead to early macrovascular infection (Basit et al., 2015). There could be a great affiliation between hypertension state and obesity. The entire pre-hypertensive subjects

agreeing to systolic blood weight were 73 (36%). The number of subjects enduring hypertension was 10 (5%). The whole pre-hypertensive subjects concurring to diastolic blood pressure were 14 (7%) and 12 (6%) subjects with hypertensive conditions as the prevalence rate of hypertension in Pakistan is 26.34% (Shah et al.,2018). Age is a risk for of hypertension and it is observed not only aged person are suffered from this but also the adult people aged 25 and above suffer from hypertension. In1967, a prospective analysis of data from the Framingham Heart Study highlighted that there is a relationship between obesity and hypertension and 78% of incident hypertension in men and 64% of incident hypertension in women was seen among the patients with obesity (>60%) (Bramlage et al., 2004). The prevalence of hypertension increased in relation to BMI in both men and women

after adjusting for age (Shihab et al., 2012). Estimates indicate that the increased risk of developing hypertension is 20–30% for every 5% increment in weight gain (Droyvold et al., 2005). This showed that hypertension is related to the obesity as it's a prominent risk factor for the development of hypertension. Treatment for hypertension is present but it has some side effects. Therefore, the proper guidelines are necessary which includes deep lifestyle modifications aiming to reduce body weight, thereby consuming a low-caloric diet with a total of 500–1,500 or 500-1,200 calories for men or women, respectively. It also include the restriction of salt intake and lower intake of saturated fats and cholesterol with increased consumption of water, fruits, fresh and raw vegetables, fish, lean meats and constant physical activity as well as adequate night sleep (Jiang et al., 2016),

CONCLUSION

The prevalence percentage of pre-diabetes in this study is 4.5% (n=9). 41.5% (n=83) of the total population had elevated systolic blood pressure and the prevalence percentage of diastolic blood pressure was 13% (n=26). Physical activity and daily exercise show an inverse relationship with diabetes, blood pressure and BMI. It can

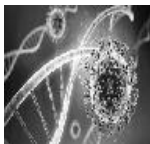
be concluded that with an increasing body mass index there is an obvious increase in high sugar levels and blood pressure in university students.

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Phytochemical Composition of Mint (*Mentha*), its Nutritional and Pharmacological Potential

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ABSTRACT: Current studies were made to investigate the phytochemical, nutritional and medicinal importance of the mint plant. Mint plant generally contains menthol (40.7%), menthone (23.4%), methylacetate (0.7-23%), eucalyptol (1-13%), carveol (0.31%), piperitone (3.20%) and fiber (1.75%±0.1). The important nutritional contents include iron (0.262%), calcium (0.158%), phytic acid (0.00092%), proteins (0.6%), vitamin E (9.89±0.15%), ascorbic acid (0.96±0.06%) and axerophthol (0.426±0.05%). Mint is one of most familiar plants that is widely cultivated throughout the planet. The plant finds immense importance in the pharmaceutical and food industry. The plant also finds colossal applications as anti-microbial, anti-oxidant, anti-bacterial and anti-inflammatory agent. The promising capability of the plant towards the field of therapeutic drugs development has been widely investigated.

Keywords: Mint, Phytochemistry, Nutritional Importance, Pharmacological Potential, Mineral contents

INTRODUCTION

Plants find an immense significance due to their nutritional (Rehman and Adnan, 2018; Naseer et al., 2019) and medicinal (Rehman et al., 2018; Saeed et al., 2020) applications and they are widely investigated for the

same reason (Kamran et al., 2020; Hussain et al., 2021). *Mentha piperita* (peppermint) is a common medicinal plant which possesses numerous health benefits for human beings and has received a greater attention from pharmaceutical as well as food industries (Loolaie et al., 2017). It is a

sterile hybrid of spearmint (*Mentha spicata*) and water mint (*Mentha aquatica*) (Murray et al., 1972). Mintplant (Fig. 1) belongs to the family “Lamiaceae” and is widely cultivated almost everywhere. The plant finds extensive applications in mint-flavored consumer products, food, confectioneries and in herb tea preparations due to its unique sweat smell and flavor. It also finds wide medicinal/pharmaceutical applications due to its antimicrobial, anti-inflammatory, anti-emetic, anti-spasmodic, carminative, diaphoretic and analgesic properties and is used to treat bronchitis, anorexia, flatulence, colitis, nausea, migraines, headaches,

anaesthetic, myalgia and liver complaints (Heywood et al., 1978; Foster, 1990; Chevallier, 1996; Lange et al., 2011). The aerial part of peppermint contains oil, synthetic resin, flavonoids, fatty acids, vitamins, minerals and hydroxy acid. The peculiar flavour constituents are synthesized and accumulated in trichomes present on the leaves surface and are responsible for creating a feeling of coolness in the mouth (Seif et al., 2019).

Keeping in view the world-wide general use of mint in food and other industries, current studies were performed to review its chemical composition, nutritional and pharmacological potential.



Fig. 1. Mint Plants

(<https://www.goodhousekeeping.com/home/gardening/a20705630/how-to-grow-mint/>)

DISCUSSIONS

Phytochemical Composition

The term “phytochemical composition” refers to the presence of

biologically active compounds in plants. The phytochemicals impart color, flavor and smell to the plants. They also contribute towards imparting a defense

mechanism to the plants against diseases (Okwu, 2005). Some studies used SPME-GC/MS (solid-phase micro-extraction coupled with gas chromatography/mass spectrometry), to verify and confirm the presence of monoterpene compounds in flower and leaves of *piperita*. It was found that peppermint is rich in compounds such as menthyl acetate, neomenthol and menthol in older plant parts (basipetal direction), whereas younger plant parts (acropetal direction) were found enriched with isomenthone and menthone. In contrast to the leaves, flowers contain higher concentration of mentho furan (Rohloff, 1999). The analysis of volatile oil of peppermint (*Mentha x piperita L.*) by GC/FID and GC-MS indicates the presence of menthone (23.4%) and menthol (40.7%). The presence of 1, 8-cineole, limonene, menthyl acetate, β -caryophyllene and β -pinene has also been reported in peppermint plant (Schmidt et al., 2009). Table 1 displayed the proximate analysis of spearmint leaves.

Table 1: Proximate analysis of spearmint leaves (Sulieman et al., 2011)

Parameter	Value
Fiber (%)	6.200 ± 0.003
Carbohydrate (%)	10.39 ± 0.15
Ca (mg/100g)	1.3
Protein (%)	1.75 ± 0.10
K (mg/100g)	2.5
Fat (%)	2.200 ± 0.003
Moisture (%)	76.010 ± 0.033
Na (mg/100g)	7.2
Fe (mg/100g)	24

About 300 various compounds have been identified in peppermint leaves that contain volatile oil. The terpenic category has the foremost outstanding features and is comprised of 9% of sesquiterpenes and 52% of monoterpenes, whereas other groups like lactones (7%), aldehydes (9%), aromatic hydrocarbons (9%), alcohols (6%) and a smaller proportion of miscellaneous components (8%) have also been reported. Among monoterpenes, menthol is a chief component (35-60%) followed by menthyl acetate (0.7-23%), menthone (2-44%), menthofuran (0.3-14%), 1,8-cineole (eucalyptol) (1-13%), isomenthone (2-5%), limonene (0.1-6%)

and neomenthol (3-4%), whereas β -caryophyllene is the major sesquiterpene (1.6-1.8%). Flavor and medicinal properties are owed to the presence of

menthol that is a very active constituent, whereas esters like menthyl acetate are

Table 2: Percentage (%) composition of essential oil of *Mentha Piperita* (Ben et al., 2019)

Sr. No.	Compounds	Formula	Retention Time	%
1	Methyl acetate	C ₁₂ H ₂₂ O ₂	16.35	0.68
2	Isomenthol	C ₁₀ H ₂₀ O	17.29	0.28
3	Limonene	C ₁₀ H ₁₆	8.30	8.00
4	Menthol	C ₁₀ H ₂₀ O	18.25	33.59
5	1,8-cineole	C ₁₀ H ₁₈ O	8.48	2.80
6	Δ -Cadinene	C ₁₅ H ₂₄	21.92	0.27
7	Caryophyllene	C ₁₅ H ₂₄	17.33	1.95
8	Carveol	C ₁₀ H ₁₆ O	19.99	0.31
9	Piperitone	C ₁₀ H ₁₆ O	19.09	3.20

responsible for minty taste and specific aroma (Riachi and De Maria, 2015). Table 2 shows the percentage (%) composition of essential oil of *Mentha piperita*.

About 98.17% different terpenic hydrocarbons are present in *Mentha piperita*'s leaves. Its various constituents are commercially utilized as flavorer and find applications in pharmaceutical, food and cosmetics industries. Menthol is employed as a staple in toothpowder, confectionary,

toothpaste, mouth fresheners, analgesic balms, chewing tobacco, perfumes, cough drops, chewing gums and candies. Tobacco industry consumes about 40% of the entire oil followed by confectionary and pharmaceutical industries (Singh et al., 2015). Mint plants are also rich in microelements. The color of leaves is because of the presence of pigments such as carotenoids and chlorophylls and is one of the important quality indicators. Color parameters are important for

freshly cut and processed herbal plants. During processing (drying) of herbs, color changes from bright green to brown due to the degradation of chlorophyll. The degradation results in the loss of magnesium ions and thus the conversion of chlorophyll into pheophytin. Chlorophyll is a green tetrapyrrole pigment which acts as a photoreceptor of sunshine energy during photosynthesis. Chlorophyll content depends upon factors such as water availability, amount of nutrients, candlepower, pollution and vegetation period (Nguyen et al. 2019; Tarasevičienė et al., 2019). There were investigations on the volatile components of essential oils obtained from stolon leaf, stolon stem, shoot leaf and shoot stem of *Mentha ravenis* is grown in semi-arid tropical climatic environment. All these oils were found to contain menthol as their major component; its lowest concentration was found in stolon (runner) stem oil (43.7%) while the shoot stem oil contained the highest percentage (78.16%). The stolon (stem and leaf) oils contain α -phellandrene and terpinolene also some significantly considerable amounts of menthol, menthone and limoneneas compared to the shoot oils. The shoot (leaf and stem) oil was found to consist of β -

caryophyllene oxide (Rajeswara et al., 1999). No yields of essential oil from the underground rhizomes of corn mint plants have been reported. The occurrence of menthofuran (0.01-0.04%) was determined through coupled gas-liquid-thin-layer chromatography in original essential oils obtained from plants grown in Argentina, Formosa, Brazil, India and Japan (Nigam and Levi, 1964).

M. piperita contains menthyl acetate (2-11%), isomenthone (2-8%), menthofuran (1-10%), menthone (15-32%), terpene (1-7%), menthol (33-60%), and eucalyptol (5-13%). Moreover, *M. piperita* leaves contain rosmarinic acid (59-67%), 19-23% of polyphenols, that embody eriocitrin, hesperidin (6-10%) and luteolin 7-orutinoside (7-12%). *M. Piperita* has alternative bioactive compounds like bitter substances, betaine, carotenes, tannins, vitamin B caffeic acid and topherols (Kamiloglu et al., 2012; Berdowska et al., 2013). Gas chromatography (GC) and thin layer chromatography (TLC) was used to analyze the chemical composition of peppermint oil (Hart and Shears, 1996). Like other medicinal plants, the yield and phytochemicals of peppermint essential oils are influenced by various factors such as environmental

conditions, geographical location, and agro-climatic requirements of the crops. The commercial production of peppermint (*Mentha piperita L.*) highly depends on the essential oil composition, ecological conditions and genetic structure affecting yield. The adaptation ability of *M. piperita* depends on the soil condition and is more favorably grown in temperate climate areas (Ben et al., 2019).

Nutritional Importance

The herbal plants have numerous health advantages which may be attributed to the presence of important nutritional contents. Both the dried and fresh mint samples were found to contain important macro-minerals (magnesium, potassium, sodium and calcium) and micro-elements (copper,

iron, manganese and zinc). Generally, both (the dried and fresh herbs) contain larger quantities of Na, Ca, Mg, K and P minerals. However, the mineral composition is higher in the dried peppermint due to an increased quantity of dry matter content. Potassium is the most abundant macro-element present in peppermint leaves. These macro-minerals (Na, Ca, Mg, K and P) are structural elements in tissues and play their role in acid-base balance as well as in cellular and basal metabolism. The trace minerals such as Cu and Zn are considered very important in enzyme, hormone and vitamin activity (Özcan et al., 2005). The important nutritional contents of *P. aromaticus* are displayed in Table 3 (Khare et al., 2011; Rout et al., 2012).

**Table 3: Nutritional Content of *P. amboinicus*
(Khare et al., 2011; Rout et al., 2012)**

S. No	Principle components	Nutrient Content
1.	Soluble Oxalate	0.02%
2.	Phytic acid	0.00092%
3.	Insoluble dietary fibers	1.56%
4.	Soluble dietary fibers	0.31%
5.	Trace metals	
	+ Iron	0.262%
	+ Zinc	0.0003%
	+ Copper	0.00012%
	+ Chromium	0.000022%
6.	Minerals	
	+ Calcium	0.158%
	+ Phosphorus	0.016%
	+ Potassium	0.138%
	+ Sodium	0.0047%
	+ Magnesium	0.088%
7.	Vitamins	
	+ Ascorbic acid	0.003%
8.	Proteins	0.6%

Minerals are essential to retain the strength of bones and for the normal functioning of heart, kidney, nerves, muscles and heart. The plant contains significant quantity of iron (0.262%) which is an essential component of hemoglobin. Hemoglobin is responsible to circulate oxygen throughout the body. Hemoglobin carries about 2/3 of the body's Fe and its deficiency results in anemia. Mint is also comprised of total xanthophylls (0.356 mg/g of dry

weight of the plant) which include violaxanthin, lutein, zeaxanthin and neoxanthin. The presence of such ingredients makes *P. amboinicus* an excellent dietary supplement (Purseglove, 1987).

Plectranthus rotundifolius tubers were reported to contain 4.72% ash, 1.36% lipid and fibre, 5.26% carbohydrate, 5.85% protein and 82.81% moisture. They also showed the presence of significant amounts of Ca,

K, Na, Ba, Ag, Sr, Se, As, Ga, Zn, Cu, Co, Ni, Fe, Mn, Cr, Al and Li indicating that *P. rotundifolius* is an excellent source of minerals. The presence of sufficient quantity of antioxidant vitamins (9.89 ± 0.15 mg/g wet weight of vitamin E, 0.96 ± 0.06 mg/g wet weight of vitamin C and 0.426 ± 0.05 mg/g wet weight of Vitamin A) indicates that these tubers may serve as a good source of vitamins; the vitamins due to their antioxidant nature, also have an excellent ability to scavenge free radicals. The antioxidant nature of *P. rotundifolius* tubers is reflected from the presence of significant quantities of antioxidant enzymes such as Glutathione S Transferase (19.68 ± 0.10 units/mg protein), Glutathione Peroxidase (31.97 ± 0.05 units/mg protein), Catalase (0.167 ± 0.16 units/mg protein) and Superoxide Dismutase (0.0651 ± 0.06 units/mg protein). Therefore, it can be concluded that *P. rotundifolius* tubers possess an excellent potential as a good nutritional source (Devi et al., 2018).

Peppermint relationship with nutrients was studied in terms of herb feed and drilling. The influence of NPK in numerous doses on the assembly of seasoning was recorded and an increase in nutrients between 23-86% was found as compared to manage variant

(Jeliazkova et al., 1997). The influence of nutrition or plant food has been studied each on healthy and aromatic plants with respect to plant growth, biomass (herb), essential oils amount and the nutrients content (Khalid, 2012). The nutrients management effect on the peppermint production was studied and found that P and K square measure accumulated in peppermint plants throughout the season with a high correlation ($R^2 = 0.838$) for P and ($R^2 = 0.894$) for K (Brown et al., 2003). The influence of nutrients concentration and salinity on some physiological indices and oil production on peppermint and lemon flower was noticed and raised levels of electrical physical phenomenon (EC) and NaCl were reported to have reduced the quantity of biomass in each species studied (Tabatabaie and Nazari, 2007). Influence of atomic number 26 concentration in relation to the volatile oil production in Japanese peppermint was studied by Misra Associate in Nursing Sharma and $5.6 \mu\text{gL}^{-1}$ of Few as found an optimum concentration. In Japanese mint, the effect of water stress has been additionally studied and a vital reduction in gas exchange, the assimilation space, recent and dry matter content, pigment, carotenoids, micronutrients and volatile oil production was found (Misra and

Sharma, 1991). The individual and combined influence of Fe and atomic number 30 on herbs production and volatile oil in peppermint was studied and a higher influence of iron compared to other metal in individual application was determined. The results show that oil content, fresh weight, and chlorophyll content increased by increasing the supply of Iron. The suitable level of Zn supply was determined to be 5 mg Zn kg⁻¹ and the optimal level of Fe supply was determined to be 10 mg Fe kg⁻¹ (Pande et al., 2007).

Pharmacological Importance

Herbs are ancient sources of drugs, flavoring, beverages, dyeing, cosmetics and fragrances. Therefore, they have attraction for cosmetics, biotechnology, food and pharmaceutical industries. Mint (*Mentha spicata*) and Peppermint (*Mentha piperita*) are among the important members of the “Labiatae” family. It's a vital herb that in the dried form is used as drugs e.g., as a stimulant and carminative. The essential oil of the plant has been reported to demonstrate useful medicinal, insecticidal, antiviral, antifungal and inhibitor properties (Chauhan and Agarwal, 2013). The oil contains larger amounts of 1, 8- cineol, terpene and dihydrocarvone (Hussain et al., 2010). The characteristic smell of

flavourer is due to the presence of “carvone” compound. The leaves of peppermint area unit are extensively utilized in herb tea and for cooking purpose to feature flavor and aroma. The essential oil obtained is widely used in food, merchandise, dental, mouthwashes, alcoholic liquors, prescription drugs, cosmetics and soaps. Additionally, it has been found to possess antiseptic, antipyretic, antimicrobial medicine, astringent, medication, stimulating, agent and anti-aging properties (Ali et al., 2002). The distinctive smell and flavor of this asteroid dicot genus species is thanks to its high Menthol content. The essential oil obtained can also be employed as carminative, stimulant, for allaying nausea, ejection, antiseptic and has some additional industrial worth too. The foremost important and abundant elements of the essential oil are isomenthone, menthyl acetate, menthol, menthofuran and menthone. The flavonoids particularly narirutin, luteolin-7-O-rutinoside, isorhoifolin, hesperidin, diosmin, rosmarinic acid and eriocitrin isolated from the plant importantly show anti-allergic effects. Menthone is additionally an important ingredient of the plant (Girme et al., 2006). Besides, the essential oil depicts antifungal and bactericide properties.

The prime constituents of the oil are: menthofuran, isomenthone, menthone, pulegone and menthyl acetate. The leaves contain isorhoifolin, flavonoid glycosides, eriocitrin, hesperidin, carotenes, cholaneluteolin-O-rutinoside and azulenes. Flavoring reduces an internal organ voidance time in dyspeptics. The binary compound and ethyl alcohol extracts exhibit medicinal potential against an extremely contagious infective agent that causes illness of cows as well as shows antiviral activity against rinderpest virus (Badal et al., 2011). Other than its extensive use in the cooking and kitchen, mint is additionally utilized in ancient system of medication and the range of medical activities of mint is broader enough (Šarić-Kundalić et al., 2009). Mint was used as a medicative herb to treat chest pain, gastralgia and its unremarkably employed in the form of tea as a stimulant digester and treats biliary disorders, enteritis, alleviate abdomen pain; dyspepsia, gastritis, viscous acidities, aerophagia, spasms of the bladder, flatulence, epithelial duct and colic (Arumugam et al., 2008; Abbaszadeh et al., 2009; Kunnumakkara et al., 2009).

Antimicrobial Activities

P. amboinicus extract, when transformed to vital oil, contains

multitudinous biological components. Phytochemical compounds possessed by mint plants show antimicrobial activity against many microorganisms such as yeast and mould (Sandhya et al., 2011; Negi, 2012; Swamy et al., 2015). Spearmint oils also demonstrate antimicrobial activities against *E.coli* bacteria (Suliman et al., 2011).

Antioxidant Activities

The volatile oil present in *P. amboinicus* possesses a massive inhibitor property against stress created in cell line induced by carcinoma that possibly is due to the presence of phytochemicals Carvocrol and thyme camphor (Manjamalai and Grace, 2012). Anti-oxidant activity of lycopene and β -carotene prevents the oxidative stress and increases the bioavailability of vascular nitric oxide (Ciccone et al., 2013).

Antibacterial Activities

Mint essential oils and extracts are successfully being employed in different food products as well as it shows flavoring activities against acidovorax citrulli i.e. a bacterium chargeable for watermelon blotch. These results prompt the chance of exploiting the flavorer as an associate in nursing medicament agent to treat contaminated seeds (Choi et al., 2016).

The anti-bacterial activities of peppermint oils are because of menthone and menthol that act against standard antimicrobial agent “Chloramphenicol” (Janssen et al., 1987).

Anti-Inflammatory Activity

The resolvent extract of *P. amboinicus* shows excellent medicinal activity. The reduced percentages of the paw swelling were noticed in the teams treated with 350 (33%) and 250 (41%) extract of the *P. amboinicus*. These paw swellings were treated from Indocin, a non-steroidal and anti-inflammatory drugs (Gurgel et al., 2009). The volatile

oil from genus “*Mentha*” specie is employed locally to treat tissue layer inflammation and is also used as an ingredient in analgesic creams. After approval for internal use, the oil from genus *Mentha* specie is additionally accustomed to treat irritable gut syndrome, duct discomfort and hurting, inflammation of the oral mucous membrane, myodynia, amenorrhoea and period, associate degreed redness, discomfort from emission cramps and is employed as an medicine (Diop et al., 2016). Table 4 displays the therapeutic effects of various *Mentha* species.

Table 4: Therapeutic effects of different *Mentha* species

Mentha Species	Country	Therapeutic Effect
M. speciata	Brazil	For the discharge of parasitic worms
	India	Carminative, Stimulant, fever antispasmodic. The boiled leaves extract is used to relieve hiccup and as anti-inflammation agent
	Morocco	Leaf and stem extract for tiredness and headache
M. rotundifolia	Iran	For the treatment of intestinal colic and flatulent dyspepsia
	Spain	Hypotensive
	France	Tonic, stomachic, stimulative, anti-inflammatory carminative, choleric, nsecticidal and sedative
M. piperita	India	Peppermint oil has been used to cure inflammation of the oral mucosa. bowel syndrome and antispasmodic
	Finland	Peppermint uses to cure cough and bronchitis flatulence, irritable bowel syndrome, indigestion,

nausea and vomiting

Mint is additionally used as buccodental bar as its leaves have potency to discolor teeth. Contemporary mint-leave area units utilized in manduction as mouthwashes reduce animal tissue pain (Lamendin et al., 2004). Mint is employed in creating dentifrices because it provides freshness to breath. A lot of studies are being done on contributions of mint leaves to prevent cavity and plaque and it is a fact that mint leaves extract produces unfavorable circumstances for microorganism (Balakrishnan, 2015). In addition, peppermint gums facilitate the cleanliness of teeth. Mint oils and their derivatives are also employed as seasoning agents throughout the globe (especially in food), pharmaceuticals, and perfumery. Mint flavor in combination with peppermint and *Mentha arvensis* is the most vital flavour which is used in citrus and vanilla. Mentha plant herbs are cultivated for dry leaves production in Federal Republic of Turkey, Nigeria, Greece, Bulgaria, Spain, Germany, Poland, Egypt, Morocco, Israel, UK, China and Morocco (Alu'datt et al., 2018; Kapp, 2015).

CONCLUSIONS

Mint plant generally contains menthol, menthone, methylacetate, eucalyptol, carveol, piperitone and fiber. The important nutritional contents include iron, calcium, phytic acid, proteins, vitamin E, ascorbic acid, and axerophthol. Mint species have colossal contributions in the production of bioactive therapeutics agents. Because of its aromaticity, the plant possesses great commercial values. It has traditionally been used as a food seasoning and to treat cold and fever. Some of the modern medicinal uses of the plant include its applications to treat gastro-intestinal and cardio vascular disorders. In addition, antimicrobial, anti-ulcer, anticancer, insecticidal, anti-diabetic and anti-inflammatory activities are some of the plethora of its biological potentials and traits. The prime reason of the pharmacological potential of the mint plant is the presence of a wide range of bioactive phytochemicals. Different chemical compounds present in the mint leaves extract open up numerous avenues of its applications in a number of fields such as cosmetics, food and pharmaceuticals. The summarized information in the paper helps to understand the chemical composition of the mint plant as well as

its nutritional and pharmaceutical importance.

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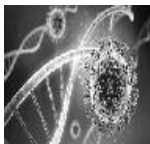
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Adverse Effects of COVID-19 in Patients with Age Associated Diseases: A Mini Review

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ABSTRACT: *The world is currently suffering from a pandemic called COVID-19 caused by the SARS-CoV-2 extreme acute respiratory syndrome coronavirus, first identified on December 31, 2019 in Wuhan, Hubei Province, China. In this review, the main focus is on the individuals infected with coronavirus while suffering from various age associated diseases such as hypertension, diabetes, obesity, and coronary heart diseases. The risk of complications such as Adult Respiratory Distress Syndrome and multi-organ failure is higher for coronavirus patients with diabetes. Depending on the global region, 20–50% of patients who were COVID positive had diabetes. Moreover, 30% of the COVID-19 patients were found with hypertension. Among COVID patients of age 50 and above, hypertension was observed as one of the most common comorbidities with increased rate of hospitalization and death. This short review highlights the basics of corona viruses, focusing on COVID-19 as well as their effects on people with age associated diseases.*

Keywords: *COVID-19, Diabetes, Hypertension, Coronary heart disease, Obesity*

INTRODUCTION

Corona viruses (CoV) are the enveloped viruses and these viruses are single-stranded RNA viruses with a positive-sense genome which are well-known for causing respiratory diseases in humans (Su et al., 2016; Cui et al., 2019). Mostly, COVID-19 infection

leads to minor upper respiratory infection in most of the immune competent individuals (Zaki et al., 2012). Conversely, in 2003 in Guangdong, China one of the two extremely pathogenic CoV have become a cause of epidemics of Severe Acute Respiratory Syndrome (SARS), while a

decade later another CoV Middle East Respiratory Syndrome (MERS) resulted in outbreak in Middle Eastern countries. Both of the SARS-CoV and MERS-CoV were known for causing SARS and MERS correspondingly. In December 2019, SARS-CoV-2; a unique type of Coronavirus (COVID-19), was recognized as coronavirus causing pathogen (Zhong et al., 2003). It was first identified in Wuhan, China. Later, after 2 months WHO declared COVID-19 as pandemic by the mid of March 2020. By the end of the month of March, in the United States, there have been reported a total of 103,942 confirmed COVID-19 cases and 1689 deaths. Worldwide, the number of confirmed cases was 595,800 and total of 27,324 deaths were stated (Muniyappa and Gubb, 2020).

However, the most likely group of the people infected with COVID-19 are the individuals having previous history of diseases i.e. hypertension, and severe obesity (BMI > 40 kg/m²) and Diabetes Mellitus (DM) etc. and also the higher death rate is observed in these individuals (Zhang et al., 2020).

Patients with Diabetes Mellitus were also more likely to contract SARS and MERS. However, Diabetes Mellitus have affected 10.5% of the overall population of the United States. People

aged 65 and over are at a higher risk of dying from COVID-19, with 26.8% already having Diabetes Mellitus (Muniyappa and Gubbi, 2020).

And of individuals diagnosed with Diabetes Mellitus, severe obesity and Hypertension are present in 15.5% and 68.4% respectively. A large portion of the US population would become infected with SARS-CoV-2 over a period of months. While a large number will remain asymptomatic and allow the virus to spread, the estimated proportion of people who need hospitalization will rise with age. Additionally, in the older group of hospitalized patients, those who require ICU care are 71% (Ferguson et al., 2020). Since the Diabetes Mellitus, excessive obesity, and hypertension are prevalent in the United States, as well as the much increased risk of COVID-19 and associated complications in patients with these diseases, the pandemic could result in significant mortality and morbidity (Muniyappa and Gubbi, 2020).

COVID-19 AND AGE ASSOCIATED DISEASES

It is now well understandable that the aged or older people with the history of already existed diseases i.e. Diabetes Mellitus, severe obesity and hypertension increases the mortality and

morbidity rates, in patients with COVID-19 (Zhang et al., 2020). It is unidentified whether only the diabetes mellitus is contributing to the increased risk of the patients, when we think through the high prevalence of cardiovascular disease, hypertension and obesity, in patients with diabetes mellitus. Though, plasma glucose levels and diabetes mellitus are independent analysts for morbidity and mortality in patients with SARS (Yang et al., 2006). Possible mechanisms that increased the vulnerability for COVID-19 in patients with diabetes mellitus include multiple parameters such as the greater affinity cellular binding or efficient viral entry within the cell, decreased rate of viral clearance, function of T cell diminished, more susceptibility to cytokine storm syndrome and hyper inflammation and the presence of cardiovascular disease (Muniyappa and Gubbi, 2020). Some of the studies have also reported that COVID-19 is related with hyperglycemia mostly in the aged people with type 2 diabetes (Xu et al., 2020).

COVID-19 AND HYPERTENSION

Importantly, it has been reported that particular comorbidities linked with higher risk of infection and adverse outcomes associated with the development of severe lung injury and

mortality. The one of the most common reported comorbidity is hypertension that was reported as 30%, diabetes and coronary heart diseases was reported as 19% and 8% respectively (Zhu et al., 2020). One study showed that hypertension was 27 percent of the most common comorbidities in patients with COVID-19 who experienced Acute Respiratory Distress Syndrome (ARDS), while diabetes and cardiovascular diseases were 19 percent and 6 percent, respectively (Wu et al., 2020).

The rate of recurrence with which COVID-19 patients are hypertensive is not fully unexpected, nor does it generally suggest a causal association between hypertension and COVID-19 or its severity, as hypertension is extremely common in the elderly, and it appears that older people are at greater risk of SARS-CoV-2 virus infection and suffering from more extreme forms and difficulties (Schifrin et al., 2020).

Recent studies showed that proportion of hypertension among COVID-19 patients, ranged from 15%-20% (Guan et al., 2020; Lianet al., 2020; Huang et al., 2020) to 30%-35% (Shi et al., 2020; Guo et al., 2020; Chen et al., 2020). These variations might have aroused due to the various reasons. Patients with elevated proportion of hypertension relatively belonged to the

higher age group (Guan et al., 2020; Lian et al., 2020) which could be a reason for these variations in proportions of hypertension. Aging is also associated with different comorbidities such as arterial hypertension, renal impairment, obesity and diabetes. These comorbidities altogether increased proportion of hypertensive patients (Liu et al., 2020).

In recent study, out of 788 COVID patients aged 46 years on average only 16% were hypertensive (Lian et al., 2020). In another study, the positive cases were 274 aged 64 years out of which 34% were hypertensive. This showed a strong association between age and hypertension among COVID patients. Moreover 48% of the hypertensive COVID positive patients aged between 62-77 years could not survive the COVID-19 infection (Chen et al., 2020).

COVID-19 AND DIABETES

Diabetes is a most important risk factor for the development of severe pneumonia due to infection of virus and it occurs in about approximately 20% of patients (Hespanhol et al., 2019; Zou et al., 2020). Diabetes was recognized as a most important contributor to the infection. Data from epidemiological studies in areas where the population has been seriously affected by SARS-

CoV-2 and numerous other findings from national health centers and hospitals and the Centers for Disease Control and Prevention (CDC) suggested that the risk of death from COVID-19 in patients with diabetes is up to 50 percent higher than in patients without diabetes (Perico et al., 2020). Many hypotheses have been explained regarding the severity and higher incidence rate of COVID-19 infection in the diabetic people. Over-all, people with all forms of diabetes are at higher risk of COVID-19 infection owing to weaknesses of innate immunity which is affecting neutrophil chemotaxis, phagocytosis, and cell-mediated immunity; however, the high rate of diabetes in serious cases of COVID-19 might strongly reflect the greater spread of type 2 diabetes in older people. Moreover, diabetes in people with older ages is also linked with cardiovascular diseases, which itself another factor, to describe the association of COVID-19 with more fatal outcomes (Bornstein et al., 2020).

Since inflammatory responses such as cytokines storms is relatively higher in patients with diabetes and associated liver diseases, so these patients are at more risk of contracting severe COVID-19 infection. Consequently, these inflammatory responses should be

screened frequently using various laboratory methods such as high-sensitivity C-reactive protein, erythrocyte sedimentation rate increasing ferritin or decreasing platelet counts. These methods can also be helpful in determining the type of immuno-suppressors that can be administered to such patients who have elevated inflammatory response. Selective cytokine blockade, immunoglobulins or steroids can be used as immuno-suppressors in such cases (Bornstein et al., 2020).

The diabetic patients often develop comorbidities such as obesity and overweight which disrupts the body mass index that may lead to altered respiratory mechanics, oxygenation during mechanical ventilation or lung volume. Hence, the diabetic and obese patients may experience more complications in case of acquiring ventilator support. As discussed earlier the immune response, both innate and adaptive is altered in such patients so they may develop chronic inflammation with high concentrations of lower anti-inflammatory adiponectin and pro-inflammatory leptin (Andersen et al., 2016).

COVID-19 AND CARDIO-VASCULAR DISEASE

Appearing to affect the myocardium, SARS-CoV-2 has become a source of myocarditis. Sporadic autopsy cases indicate myocardial invasion by interstitial inflammatory mononuclear cells (Xu et al., 2020). Parallel to this, after COVID-19, cases of extreme myocarditis with decreased systolic function were identified. As indicated by cardiac biomarker research, a high prevalence of heart injury has been identified in hospitalized patients (Xu et al., 2020; Shi et al., 2020; Guo et al., 2020). Myocardial injury is likely to be linked to myocarditis associated with infection and remains an important prognostic dynamic in COVID-19 (Madjid et al., 2020).

It has been observed during the influenza epidemics that majority of the people died because of the cardiovascular diseases instead the cause of their death was pneumonia-influenza (Madjid et al., 2004).

Recent studies showed an association amongst cardiovascular metabolic diseases and MERS and SARS (Yang et al., 2006; Badawi and Ryoo, 2016). A total of 637 MERS-CoV cases were analyzed which showed that hypertension and diabetes are present in 50% of the cases while cardiac diseases are prevalent in 30% of the patients (Badawi and Ryoo, 2016). As the

COVID-19 spreads and the number of cases increases, it has been observed that large number of COVID-19 infected individuals show comorbidities i.e. diabetes, cardiovascular diseases and hypertension. In another study 99 cases was analyzed, out of which 40% patients had cardiovascular disease (Chen et al., 2020), further in 41 cases of Huang’s study, 20% patients were diabetic (Huang et al., 2020).

Moreover, it has been reported that patients infected with corona virus can develop long-term metabolic alterations, as has been reported previously with the SARS virus. Hence, a special care is needed for the cardio-metabolic nursing

of patients who have survived severe COVID-19 disease (Li et al., 2020).

SARS-CoV-2 patients develop more severity when the virus’s S-protein binds to the angiotensin- converting enzyme 2 (ACE2), which is extensively expressed in the kidneys, gastrointestinal system, lungs and heart and it plays a key role in multiple cardiovascular and immunological pathways (Walls et al., 2020).

According to the studies conducted on January 2020 in the different hospitals of china, the viral infection was observed in the people with cardiovascular diseases described in the table 1.

Table 1: Number, age, sex and cardiovascular metabolic diseases of patients (Li et al., 2020)

Hospital	Number of patients	Ages	Sex (male %)	Cardiovascular metabolic diseases		
				Hypertension %	Diabetes %	Cardiovascular diseases %
Zhongnan Hospital	138	56 (42–68)	54.3	31.2	10.1	9.6
Jinyintan Hospital	41	49 (41–58)	73	15	20	15
552 hospitals in China	1099	47 (35–58)	59.2	14.9	7.4	3.9
9 tertiary hospitals in Hubei	137	57 (20–83)	44.5	9.5	10.2	7.3

COVID-19 AND OBESITY

Intestinal obesity is linked with diminished ventilation of the base of the lungs which in return resulting in low oxygen saturation of blood (Peters and Dixon, 2018). Moreover, the irregular exudation of cytokines and adipokines such as interferon and tumor necrosis factor-alpha describe a chronic low-grade inflammation characteristic of intestinal obesity, which may harm the immune responses (Huttunen and Syrjanen, 2013) and have the adverse effects on the bronchi and lung parenchyma (Zhang et al., 2018). Overall, it seems probable that obesity possibly will be an independent risk factor for SARS-CoV-2 (Ryan et al., 2020).

Obesity, on the other hand, has been identified as an independent risk factor for severe H1N1 lung infection (Van et al., 2011). Furthermore, abdominal obesity is linked to the poor ventilation at the base of the lungs, resulting in lower blood oxygen saturation (Peters and Dixon, 2018). Additionally, aberrant release of adipokines and cytokines such as tumour necrosis factor-alpha and interferon characterizes a persistent low-grade inflammation associated with abdominal obesity, which may obstruct

immune response (Huttunen and Syrjanen, 2013) and have consequences on the bronchi and lung parenchyma (Zhang et al., 2018). Overall, it suggests that obesity may be an independent risk factor for SARS-CoV-2 infection (Ryan et al., 2020).

CONCLUSION

Although COVID-19 has affected all age groups but patients with already existing comorbidities are at higher risk of getting severe Covi-19 infection. It has been observed throughout the pandemic that COVID-19 patients having comorbidities such as diabetes, hypertension and Cardiovascular disease had more rates of hospitalization and mortality. These comorbidities increased ventilator complications among aged patients. As the pandemic is still ongoing, the surveillance of the disease and risk factors as well as therapy modalities should be closely observed.

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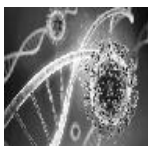
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Prevalence and Associated Risk Factors of Coccidiosis in Small Ruminants in Dera Ghazi Khan, Punjab, Pakistan

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ABSTRACT: *The goal of the present research was to figure out the prevalence and risk factors of coccidiosis in goats and sheep in Dera Ghazi Khan. For this 752 (goats=376; sheep=376) fecal specimens were obtained, and were analyzed by coprological examination. The prevalence of coccidiosis in sheep (52.92 %) was significantly higher ($P<0.05$) than the goats (44.41 %). In females, infection with Eimeria was significantly higher ($P<0.05$) as compared to male animals. Coccidiosis was significantly more common ($P<0.05$) in sheep and goats aged ≤ 6 months compared to sheep and goats older than 6 months but less than a year, and older than a year. There was a clear distinction ($P<0.05$) in prevalence of coccidiosis in animals that are stall fed and housed in comparison with the animals that graze in open grasslands. Prevalence of coccidiosis in animals with low BCS was considerably higher ($P<0.05$) as compared to the animals in good health. The prevalence of Eimeria infection and fecal score had a significant correlation ($P<0.05$). Prevalence of coccidiosis was higher in August while in October it was lowest. The highest prevalence (56.78%) was of E. ovinoidalis followed in order by 47.23 % E. ahsata, 35.67 % E. parva, 30.15 % E. intricate, 26.63 % E. faurei and 19.09 % E. pallid in sheep. In case of goats, highest prevalence (68.86%) was of E. ninakohlyakimovae, followed by 59.88% E. alijevei, 53.29% E. arloingi, 46.70 % E. caprina and 22.15 % E. hirci were among the most common Eimeria spp. It was concluded that different Eimeria spp. Prevailing in study area with variable risk factors and the incidence of coccidiosis in research area was affected by various risk variables.*

Keywords: *Eimeria; small ruminants; incidence; risk parameters.*

INTRODUCTION

Sheep and goats are the major farm animals of man and are particularly important in more drastic conditions of the world. About two-thirds of their global population exist in the developing countries where they make a large contribution to the agricultural enterprises (Tony, 2007).

Eimeria parasites (Apicomplexa: Eimeriidae) are known to be a significant source of intestinal disease in livestock globally (Ahmad et al., 2016). These protozoa are accountable for the deadly disease “coccidiosis”, which affects vertebrates and small ruminants (Mohamaden et al., 2018). Among these animals, goats and sheep are most frequently infected by *Eimeria* species, resulting in significant financial losses, either in the form of actual costs and production, which straight away impacts the welfare of animals (Silva et al., 2014).

Multiple species of *Eimeria* have been documented in goats (~17 species) and sheep (~15 species) globally (KhodakaramTafti et al., 2013). The major species affecting sheep are primarily infected by *Eimeria crandallis* and *Eimeria ovinoidalis*, while goats are primarily infected by *Eimeria ninakohlyakimovae* and *Eimeria arloingi* (Chartier

and Paraud 2012; Souza et al., 2015; Sharma et al., 2017). *Eimeria* spp. are mainly transmitted through the intake of sporulated oocysts (Bakunzi et al., 2010; Hashemnia et al., 2015). They parasitize the inner layer of the digestive tract giving rise to dysentery; often it includes (blood or mucus) and then impacts the wellbeing of animal as reduction in weight, hunger, blood deficiency, wool breaking, exhaustion and mortality (10-40% morbidity and 10% mortality) (Phil, 2017).

The disease usually occur in young animals but in extreme conditions, the mature animals are also affected (More et al., 2011). Small ruminants of all age groups and races are prone to *Eimeria* infection; nevertheless, lambs whose age is from 3 weeks to 5 months are quite seriously infected by outburst of coccidial infection, whereas the remaining herd may serve as vectors (Rehman et al., 2011). In general, *Eimeria* spp. are identified by examining the structural characteristics of sporulated oocysts under a microscope, which include oocyst remnant, mass, sporulation period, micropyle, and polar cap (Kawahara et al., 2010; Nahavandi et al., 2016).

As earlier documented for various ruminant species, a range of factors

might affect the occurrence of coccidiosis such as young age, pressure, immunological response, population of animal or animal count per unit (flock size), other factors associated with the livestock management, along with weather patterns (Cai and Bai, 2009; Carrau et al., 2018; Rehman et al., 2011; Silva et al., 2014). In the present research, we intend to look into the incidence of coccidiosis and various risk parameters associated with it.

MATERIALS AND METHODS

Geographical Position of Area of Research

Dera Ghazi Khan is located at an elevation of 112 meters above sea level and is located at 30°03 "N, 70°38" East. The weather in the area is mainly dry with little precipitation. The location receives 125 mm of rain per year. The cold season is mild, and the weather is hot for the rest of the year. During the summer, the average temperature is 115°C, while the average temperature during the winter is as low as 40°C.

Incidence of Coccidiosis in Goats and Sheep

A sum of 752 excreta specimens (goats = 376 and sheep =376) were obtained haphazardly from various regions in Dera Ghazi Khan and investigated for the occurrence of

Eimeria oocysts. At the time of specimen collection, information about each goat and sheep was recorded in a data record file. The following data was entered into the record file: description (owner's name and address), animal characteristics (breed, race, age, and gender), illustration of residential area (enclosed or with outside accessibility, if enclosed, floored yard or mud), and fodder method (graze, stall or both), bodily state (1 = bad, 2 = low, 2.5 = moderate, 3=good, 4=obese), faecal score (1 = regular; 2 = delicate, does not keep shape; 3 = liquidy, disperses quickly; 4=deprived of rigid material), outcomes (+ve, -ve and species identified).

Excreta Specimen Collection and Analysis

After putting on disposable gloves, 5g excreta sample was taken from the rectum of each goat and sheep. Excreta specimens were collected and placed in sealed polythene sacks, which were then labeled and kept in an ice-cold container for shipping to the Medicine Laboratory at UVAS (University of Veterinary and Animal Sciences) in Lahore. The specimens were kept in the laboratory at 4°C till treatment but lasting no longer than 48 hours. The Salt Flotation Technique and Direct Smear Method, as outlined by Zajac and Conboy, (2006)

were used to examine excreta for the presence of *Eimeria* oocysts.

Recognition of *Eimeria* species

The morphology of the oocysts (shape, size, color, and look of the oocyst surface, presence or absence of polar cap and micropyle) were used to identify *Eimeria* species utilizing a grouping criteria defined by Iqbal et al. (2006). Eventually, the coccidiosis incidence was calculated using the formula below.

$$\text{Incidence (\%)} = \frac{\text{No. of infected subjects (n)}}{\text{Total no. of investigated subjects (N)}} \times 100$$

Statistical Analysis

The Chi-square test was used to assess the data and a statistically significant difference was defined at probability level ($P < 0.05$). For statistical examination, SPSS software edition 20 was used.

RESULTS

Facts on incidence of coccidiosis in goats and sheep were determined.

It was noticed that *Eimeria* oocysts were found in 48.67 % (366) of the 752 excreta samples (goats = 376 and sheep = 376). Sheep had a significantly higher ($P < 0.05$) incidence of coccidiosis than goats, according to statistical analysis. A step-by-step Chi-Square analysis was performed on all suspected risk variables. *Eimeria* infection was significantly greater in female animals ($P < 0.05$) than in males.

Fig. 1 demonstrated the facts on the incidence of coccidiosis in various age categories. Coccidiosis was significantly more common ($P < 0.05$) in the 6 month or less age group, which was followed by a group older than 6 months but less than a year and older than a year age group.

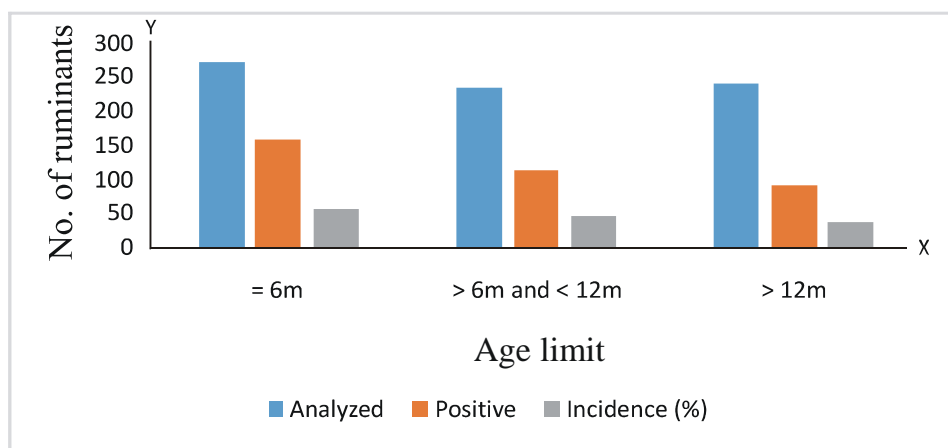


Fig. 1. Age-wise incidence of coccidiosis in small ruminants in Dera Ghazi Khan

Fig. 2 showed the prevalence of coccidiosis in various races of goats and sheep. When the incidence of coccidiosis was compared between different races of goats and sheep, there was no significant difference ($P>0.05$) between both species.

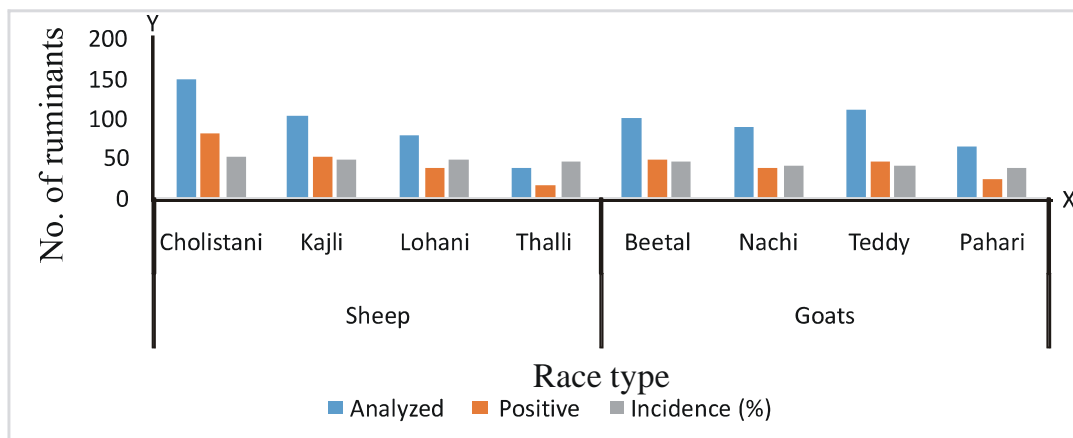


Fig. 2. Race dependent incidence of coccidiosis in small ruminants in Dera Ghazi Khan

Fig. 3 showed that the incidence was considerably greater ($P<0.05$) in enclosed and mud housed living environment relative to the outside and concreted living environment. Facts on nutrition showed a clear distinction ($P<0.05$) in 3 fodder methods that are stall feeding, pasturing and combined stall feeding + pasturing (Fig. 4).

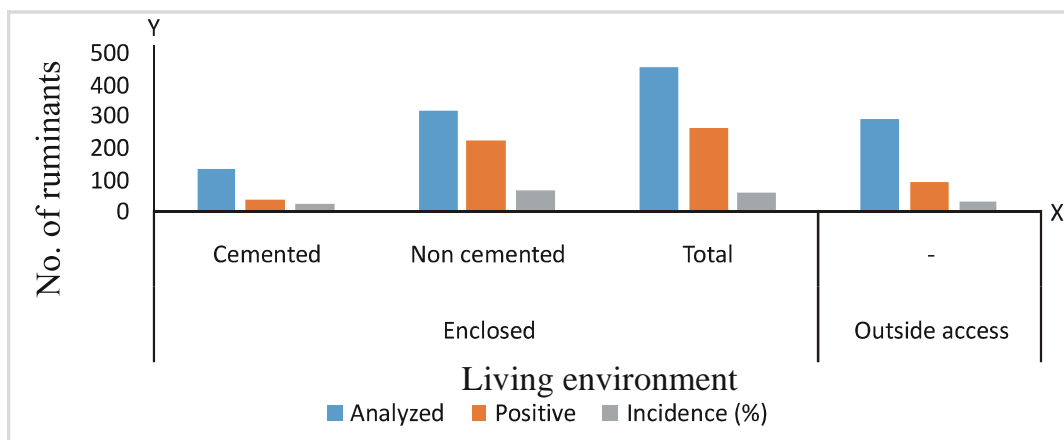


Fig. 3. Living environment dependent incidence of coccidiosis in small ruminants in Dera Ghazi Khan

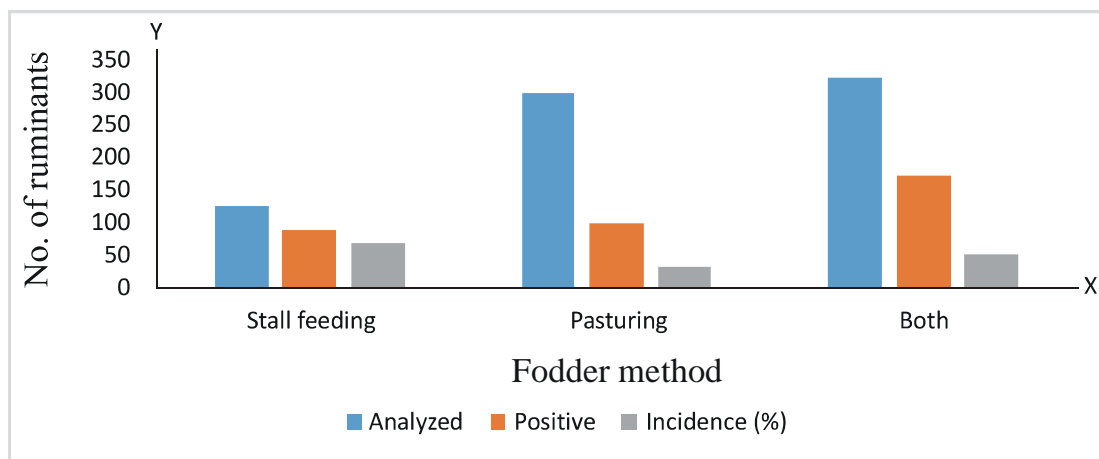


Fig. 4. Fodder method based incidence of coccidiosis in small ruminants in Dera Ghazi Khan

Fig. 5 demonstrated that animals as compared to the animals having moderate and healthy bodily state. Coccidiosis prevalence was considerably higher ($P < 0.05$) in down and sick state.

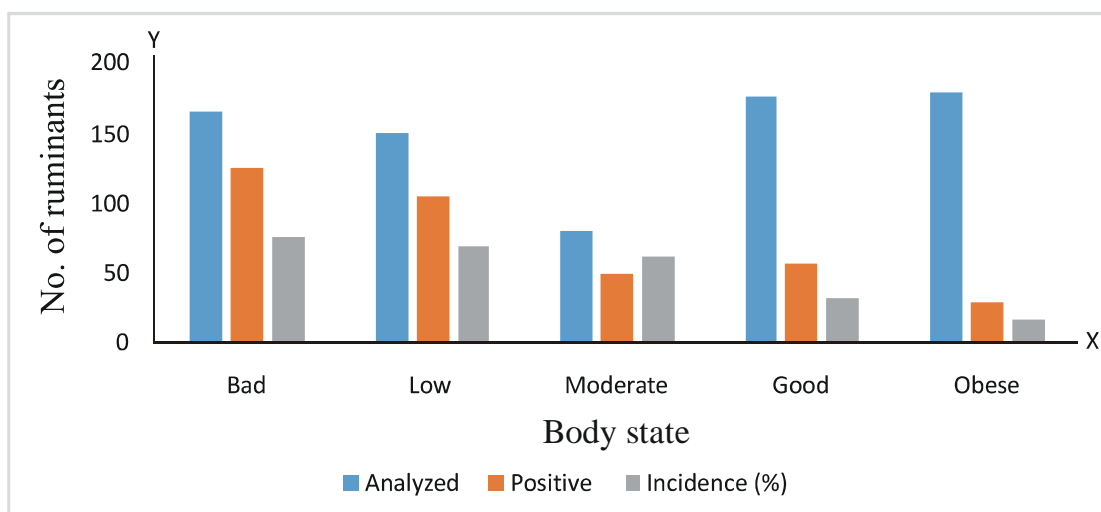


Fig. 5. Incidence of coccidiosis as affected by body state of small ruminants in Dera Ghazi Khan

In (Fig. 6) the incidence of *Eimeria* infection was found to have a strong relationship ($P < 0.05$) with fecal score, with animals having diarrhea had a significantly higher frequency ($P < 0.05$) than normal animals. On comparing month-by-month incidence of coccidiosis in goats and sheep, a clear distinction ($P < 0.05$) was noticed.

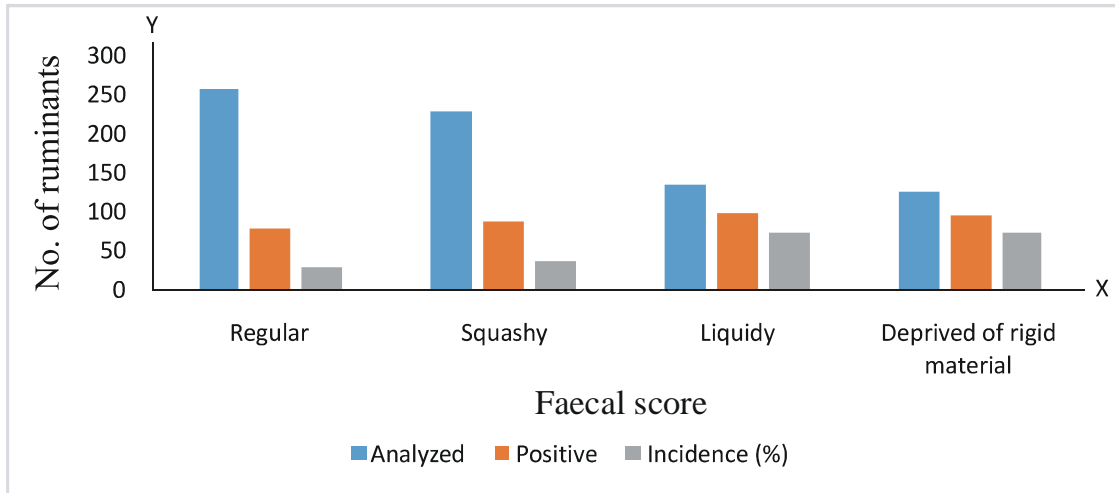


Fig. 6. Incidence of coccidiosis as affected by faecal score of small ruminants in Dera Ghazi Khan

Six *Eimeria* spp. were found in sheep in current research and incidence of every specie was *E. ovinoidalis* (56.78%), *E. ahsata* (47.23%), *E. parva* (35.67%), *E. intricate* (30.15%), *E. faurei* (26.63%), *E. pallida* (19.09%)

(Fig. 7). *E. ninakohlyakimovae* (68.86%), *E. alijevei* (59.88%), *E. arloingi* (53.29%), *E. caprina* (46.70%), *E. hirci* (22.15%) were the 5 species identified in goats (Fig. 7 and 8).

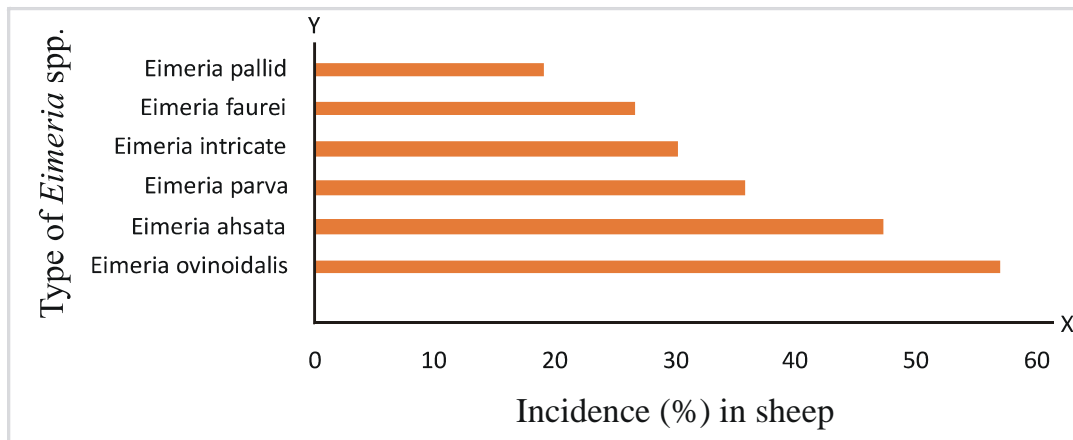


Fig. 7. Incidence of different *Eimeria* species recognized in Sheep in Dera Ghazi Khan

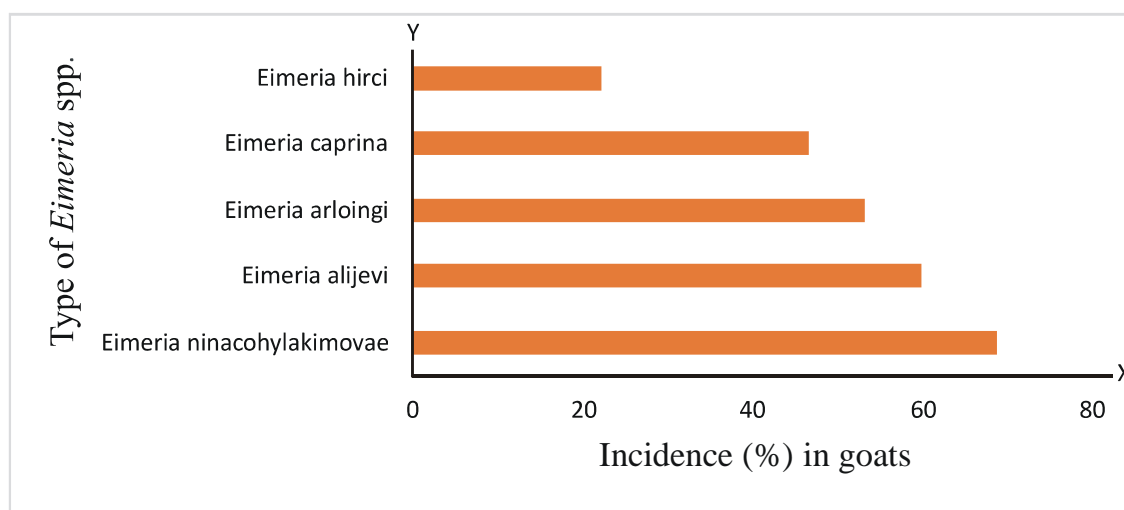


Fig. 8. Incidence of different *Eimeria* species recognized in goats in Dera Ghazi Khan

DISCUSSION

Goats and sheep were found infected with *Eimeria* spp. (Chartier and Paraud, 2012). Coccidial infection was found in 44.41% of goats and 52.92% of sheep in the current research. The observed incidence in sheep was almost same to the current Egyptian figure of 57.7% (Mohamaden et al., 2018), the 57.5% in Iraq (Al Saadoun and Al-Rubaie, 2018) and the 47.8% in Brazil (de Macedo et al., 2020). Nevertheless, the incidence of *Eimeria* spp. infection in goats was less compared to 66.9% documented in Ethiopia (Kiltu et al., 2016), the 89.9% in Iran (Kheirandish et al., 2014) but more than the degree of infection documented in India (23%) (Das et al., 2017).

In present research, female goats and sheep had a higher rate of *Eimeria* spp. as compared to the males. This

result is consistent to the prior findings (Rehman et al., 2011; Mohamaden et al., 2018), which stated that does and ewes are subjected to physiological pressure linked with gestation, kidding and nursing that render them more vulnerable to *Eimeria* spp. infection relative to males (Kahan and Greiner, 2013; Mohamaden et al., 2018). The incidence of coccidian oocysts in this analysis was lesser in mature goats and sheep relative to the ewes and infants that supports the prior reports (El-Shahawy, 2016). This is related to the increasing likelihood of accessing the source of *Eimeria* spp. infection as sheep and goats grow older, as well as the building of better tolerance or developed resistance to coccidian in mature goats and sheep compared to lambs and newborns (Wang et al., 2010).

The incidence of *Eimeria* infection in various goat and sheep races did not vary significantly. Same findings were documented by Biu et al. (2009) about breed vulnerability to *Eimeria*. In case of living environment greater incidence rate was noticed in non-cemented floor compared to cemented floor. The similar behaviour of incidence was documented by Rehman et al. (2011) who observed more incidence in non-cemented floor (48.5%) as compared to cemented floor. The difference could be reflected from the fact that urine accumulates in the non-cemented floor and raises the temperature; thus providing hot and moist atmosphere suitable for oocysts sporulation (Lawrence, 2011). *Eimeria* infection was remarkably more in stall feeding animals (71.65%) than in pasturing animals (33.33 %). Khan et al. (2011) also confirmed these findings as he documented 17.5 % incidence of *Eimeria* in pasturing and stall feeding sheep and 56.02 % in goats, accordingly.

An important strong association was observed between body state score and *Eimeria* infection in my research. This result is consistent with Khan et al. (2011) who stated that the sheep with poor body state score has greater infection rate as compared to the good score animal. This may be attributed to

the weakened immune systems of poor score animals due to of undernutrition and various parasitic infections which resulting in immuno-compromising. This state promotes increased risks of infection in poor state animals in comparison with good score animals (Radostitis et al., 2007).

In sheep having diarrhea, the rate of *Eimeria* infection increases prominently compared to the sheep with usual and soft excreta consistency. This result coincides with the findings of (Yakhchali, et al 2010). The prevalence of infection was maximum in autumn (51.5%), accompanied by summer (31.3%), whereas the minimum infection rate was in winter season (16%) (Alkhatam et al., 2020). It may be due to the reason that the weather is quite hot in summer and it could be a stressful element for the animals which tends more shedding of protozoa whereas autumn indicates more degree of infection because of the moisture that is more suitable for sporulation of oocysts (Taylor et al., 2003)

Six *Eimeria* spp. were identified in sheep in the current research and incidence of every specie was also reported by (Galip, 2004; Skirnisson, 2007; Yakhehali and Golami, 2008; Cai and Bai, 2009; Wag et al., 2010; Khan et al., 2011; Silva et al., 2011) and five

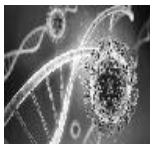
species reported in goats were also documented by (Abo-Shehada and Abo-Farieha, 2003; Agyei et al. 2004; Abdurrahman, 2007; Wag et al., 2010; Cavalcante et al., 2011; Rehman et al., 2011; Zhao et al., 2012).

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Association of Obesity with Covid-19 and Nutrition Perspective

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ABSTRACT: *COVID-19 is a disease that cause respiratory illness due to novel corona virus. It was reported by WHO on December 31,2019 for the first time. The outbreak of this disease started from Wuhan city, China. Now COVID-19 has been declared as a universal pandemic. The epidemiological outcomes of COVID-2019 have not been completely understood yet. The present review tried to find association between obesity and COVID-19, also the extent of severity it may cause in the disease.*

Keyword: *Universal pandemic, COVID-19, Nutritional needs, Obesity.*

INTRODUCTION

BMI that is equal to 30 Kg/m² or above is classified as obese or overweight. 26% grown-ups and 46% young ones are affected by obesity globally. A complex relationship between genetics, socioeconomic and cultural impacts together constitute obesity. Dietary patterns and lifestyle choices have a great impact on the prevalence of obesity. Urban development also plays its role in it. Obesity increases a person's chances of developing comorbid conditions e.g.

high blood pressure, respiratory problems, dyslipidaemia, sleep disturbances and some type of cancers (Apovian, 2016). In China, city Wuhan, an outbreak of pneumonia of unknown aetiology appeared at the end of 2019. WHO termed this new and unusual coronavirus that was its causing agent as COVID-19 (Coronavirus disease of 2019). This virus was correlative to MERS and SARS. It is a beta-coronavirus affecting lower respiratory tract of humans and is noticeable as pneumonia in them (Sohrabiet al.,

2020). It is shown by research that transmission of COVID-19 can take place during incubation period before the appearance of symptoms in those patients. Moreover, phlegm was present in a patient of recovery phase from SARS-CoV-2 (Rothe et al., 2020). COVID-19 can roughly be divided into 3 stages; first is asymptomatic (carrying virus but no symptoms evident); second is symptomatic (virus symptoms present and also it is non-severe) and finally third severe (respiratory problems and symptoms evident (Wang et al., 2020). This virus is similar to flu in a way that it spreads from one individual to another through drops, like when coughing or sneezing or talking, if it makes contact with the mucosa. Infection can also spread through infected surfaces if a

person touches any surface and afterwards touches the mouth, eyes or nose. Droplets are not able to travel far from 2m of distance and they also don't remain in the air (Zou et al., 2020).

Types

Coronaviruses that affect humans are of six types causing disease in them. Two of them MERS coronavirus and SARS coronavirus are the severe types. These two types have caused epidemics with high death rates. Whereas the other four types of coronavirus are mild causing general respiratory problems (Kooraki et al.,2020). According to the clinical findings about COVID-19, infected patients are divided into the following types as shown in table 1:

Table 1: Types of COVID-19 (Zu et al., 2020)

TYPES	CLINICAL FINDINGS
Mild	➤ Fever less than 38□ (can end without treatment)
	➤ Cough may be present or not
	➤ No shortness of breath, no gasping
	➤ Pneumonia not present
Moderate	➤ Fever
	➤ Respiratory problems
Severe	➤ Pneumonia
	➤ Respiratory rate higher or equal to 30 per minute
	➤ Oxygen saturation that is less than 93% in rest state

- Partial pressure of oxygen /Flow rate of oxygen less than 300 mmHg
- Rapid progression of COVID-19
- Lung failure
- Critical**
- Trauma
- Organ failure, ICU is needed

METHODOLOGY

The current review material was searched from Google Scholar, Wiley library and PubMed library for authentic literature from December 2019 to September 2021. In this review 90 articles including case reports and case series were selected. Out of 90, 72 articles were related to current topic. All unpublished data were excluded.

Prevalence of COVID-19 in Obese Patients

The Covid-19 pandemic is rapidly spreading the world over, strikingly in Europe and North America, where weight is extraordinarily normal. Weight (BMI >30 Kg/m²) and genuine heftiness (BMI >35 Kg/m²) were accessible in 47.6% and 28.2% of cases, independently. When all is said in done, 85 patients (68.6%) required Invasive Mechanical Ventillation (IMV). The degree of patients who required IMV extended with BMI classes (p<0.01), and it was generally critical in patients with BMI >35 Kg/m² (85.7%). The odds

extent for IMV in patients with BMI >35 Kg/m² versus patients with BMI <25 Kg/m² was 7.36 (Simonnet et al., 2020). Besides, the rising regularity of obesity in the United States and related information on the impact of weight on mortality from H1N1 influenza should fabricate the affectability of clinicians pondering patients with chunkiness and COVID-19 to the prerequisite for compelling cure of such patients (Dietz and Santos-Burgoa, 2020). Americans have higher BMI than those from China—the ordinariness of obesity in the US was 42.4% in 2017-2018—yet Americans in like manner have a high weight of class III strength, with 9.2% of the masses with BMI >40 Kg/m². This has certifiable repercussions for our human administrations system. Individuals with genuine rotundity who become debilitated and require heightened care (5% of defilements) present challenges in calm organization—more bariatric crisis center beds, all the all the more testing intubations, progressively difficult to get

an imaging examination (there are weight confines on imaging machines), dynamically difficult to position and transport by nursing staff (Ryan et al., 2020). From February seventeenth to April fifth, 103 patients were hospitalized with COVID-19. Among them, 41 patients (39.8%) were admitted to the ICU and 29 (70.7%) required IMV. The regularity of weight was 47.5% (49/103). In a multivariate assessment, outrageous robustness (BMI ≥ 35 Kg/m²) was connected with ICU assertion (Kalligeros et al., 2020). In a dataset of 265 patients (58% male patients), a colossal banter relationship was found among's age and BMI, in which progressively young individuals admitted to clinical facility will undoubtedly be fat. There was no differentiation by sex ($p=0.9$). The average BMI was 29.3 Kg/m², with only 25% of individuals having a BMI of under 26 Kg/m², and 25% outperforming a BMI of 34.7 Kg/m² (Kass et al., 2020). Similar results were observed by Cai and coworkers in a study conducted among 383 patients, (Cai et al., 2020).

In another study 200 patients were enrolled (female sex: 102, African American: 102), with an average BMI was 30 Kg/m². The middle age was 64 years In this acquaintance of

hospitalized patients with COVID-19 of each a minority-pervasive commonalities, weight, extending age, and male sex were self-rulingly associated with higher in-crisis facility mortality and when everything is said in accomplished increasingly horrible in-clinical center results (Palaiodimos et al., 2020). A study was conducted to explore the relationship between obesity and COVID-19, both are pandemic worldwide. Statistical analysis showed that more patients with severe COVID were overweight and obese as compare to others and obese patients had more worst outcomes than non-obese. This study indicated that obesity aggravates COVID-19 (Yang et al., 2021).

Association of COVID-19 with Obesity

The COVID-19 pandemic, includes in getting the consideration worldwide and it is presented by the extreme intense respiratory disorder coronavirus 2 (SARS-CoV-2) (Gao et al., 2020). In the pathogenesis of COVID-19 disease, obesity assumes a significant job. The insusceptible framework, which is official in the pathogenesis of COVID19, assumes a significant job in weight instigated fat tissue aggravation. In the fat tissue the irritation brings about metabolic brokenness conceivably prompting

dyslipidemia, type 2 diabetes mellitus, insulin obstruction, hypertension and cardiovascular sickness. Obesity has been expanded the vulnerability to contaminations (Kassir, 2020). Coronaviruses (CoVs), wrapped positive-sense RNA infections and there are gathering of infections in the human respiratory tract that can cause contaminations, which can be described clinically from delicate to untreatable. The extreme intense respiratory condition coronavirus 2 (SARS-CoV-2) is the infection capable. COVID-19 the worldwide spread can be portrayed the most exceedingly awful pandemic in humankind in the earlier century. Until this point in time, the infection COVID-19 has contaminated in excess of 3,000,000 individuals comprehensively and killed in excess of 200,000 individuals. This infection can be contaminated all the age gatherings, however progressively genuine sign that can likely bring about death are distinguished in more seasoned individuals and those with key ailments, for example, cardiovascular and aspiratory ailment. New information report progressively extreme side effects and even an unsafe expectation for the large patients. A developing assemblage of exhibit associate corpulence with COVID-19 and from invulnerable

framework movement the quantity of instrument decline to incessant aggravation are included. Lipid peroxidation makes responsive lipid aldehydes which in a patient with metabolic turmoil and COVID-19 will influence its expectation. At long last, pregnancy-related stoutness should be contemplated extra in connecting to COVID-19 as this disease could present high peril both to pregnant ladies and the baby. The relationship of corpulence with raised passing rates contrasted with non-fat individuals who have a common infection (H1N1) has been expressed. Another examination in 30 individuals with COVID-19 gave that patients BMI 27.0 ± 2.5 show with increasingly serious indications when contrasted with patients with BMI 22.0 ± 1.3 (Petrakis et al., 2020). It is turning out to be certain that few reasons put individuals living with higher weight at higher danger of the sickness. On April 17, 2020 the World Health Organization confirmed that those living with obesity has higher threat in danger of the illness (Finer et al., 2020). Utilization of large number of calories by the body leads to being overweight. This happens because of high sugar and fat enriched meals and decline in physical action. A few people may get discouraged, or not competent to do any type of activity and others

eating more nourishments with no exercises because of terrible updates on degree COVID-19, which might be the explanation of weight gain and getting corpulent (Abbas et al., 2020).

Individuals who have diabetes with obesity should ensure that they keep up great glycemic control, as it can help lessen disease hazard and seriousness. Individuals who are living with both obesity and type 2 diabetes may likewise require progressively ordinary blood glucose observing (using self-checking blood glucose gadgets, for instance) and medicine acclimation to keep up standard glycaemia to adjust to the new vitality necessities of diminished action and vitality consumption. Moreover, old people (>65 years) with type 2 diabetes were likewise bound to be influenced by COVID-19. The latest information from New York City shows that the variables most connected with hospitalization hazard were age and heftiness (BMI >40 Kg/m²), trailed by cardiovascular breakdown and ceaseless kidney malady. This investigation likewise found that increased weight was the most grounded chance factor for creating intense respiratory misery disorder and requiring intubation (Frühbeck et al., 2020). To characterize the relationship of obesity on COVID-

19, national or global review enormous scope clinical investigations of emergency clinic confirmations should be guided. A few such littler, or provincial, contemplates are on-going, showed that the most normal comorbidities spoke to in the extreme COVID-19 contaminated population are hypertension, obesity and diabetes (Samuels, 2020). The human angiotensin-converting enzyme 2 (ACE2) is reputed receptor for corona virus. ACE2 facilitates corona virus to enter the host body. ACE2 receptors are abundantly present in adipose tissues. Obese individuals with increased amount of adipose tissues contain significantly high number of ACE2. Increased ACE2 levels mean increased susceptibility to infection (Covid-19) (Bolourian and Mojtahedi, 2020). Certain pathways / molecules, hyper activated in obese hosts and shared with those in coronaviruses, could further rationalize the association of obesity with COVID-19.

A study was designed to find out the association between COVID-19 and BMI. Literature was searched from Embase database and Pubmed. Articles were searched on the basis of BMI, covid severity and mortality. Total sixteen studies were selected, out of which 9 studies showed a great

association between higher BMI and Covid-19 outcomes. Meta-analysis showed that patients with BMI greater than normal had severe covid-19 outcomes with p-value less than 0.001 (Soeroto et al., 2020). It has been studied that Coronavirus triggers an incommensurate immune response which leads towards a destructive systemic injury. This systemic injury causes more inflammation in obese as compare to others. The mechanism behind this

phenomenon is that immune cells produced as a result of injury accumulate in adipose tissues where these immune cells combine with paracrine adipocytes and produce a huge range of cytokines (Bhattacharya et al., 2020). Increased cytokines production in visceral adipose tissues cause systemic and pulmonary inflammation, as shown in Fig. 1 (Almerie and Kerrigan, 2020).

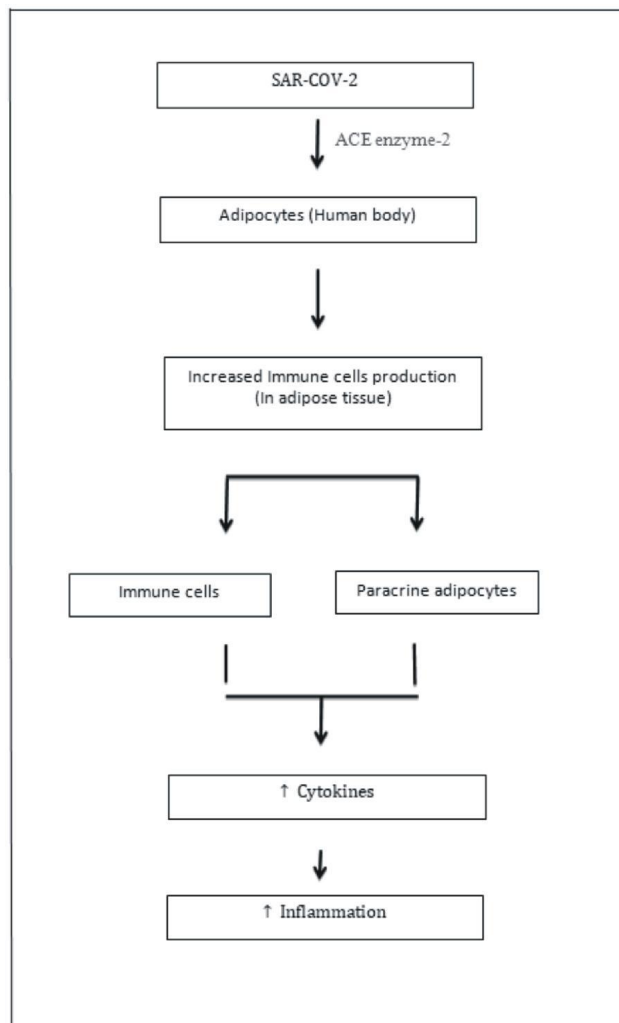


Fig. 1: Mechanism of inflammation caused by SAR-COV-2s

Mechanisms behind the association between obesity and COVID-19 are increased cytokines production (Dugail et al., 2020), altered mammalian target of rapamycin (mTOR) pathway, increased ACE2 receptors and destructive immune response. Obesity has been associated with poor pulmonary function and mechanical ventilation in patients with COVID-19. Along with COVID-19 obesity may lead toward other complications such as hypertension, CVD, diabetes and renal failure. That's why mortality rate in COVID patients is more among obese (Caci et al., 2020).

A study was conducted to find out effect of obesity on the progression of COVID-19. In this study total 95 patients were divided into two equal groups obese and non-obese group depending upon their Body mass index. Blood tests, clinical characteristics and chest computed tomography were collected for prognosis of disease. Statistical analysis showed that mortality rate was higher in COVID-19 patients with obesity. It was also observed that the rate of pulmonary changes were more common in obese group. Total lymphocytes, CRP, triglycerides, alanine aminotransferase (ALT), ESR and IL-6 levels were also increased in obese group as compare to

non-obese. Findings of this study indicated that obesity is a risk factor of Covid-19 and its progression (Kang et al., 2020).

Obesity and Immunity

Coronavirus sickness 2019 (COVID-19) is most exceedingly terrible pandemic, has asserted >125,000 lives worldwide to date. Developing investigators for poor results incorporate propelled age, male sex, prior cardiovascular sickness, and the hazard factors, which are including hypertension, diabetes, and, all the more as of late, obesity is included the rundown. (Skalny et al., 2020). Considering the current pandemic of COVID-19 where no compelling preventive and helpful medication is accessible, the most significant weapon is a sound safe framework. There are a few nutrients and follow components which are vital for the typical working of the resistant framework. Supplementation of nutrients and follow components have demonstrated positive effect on upgrading insusceptibility in viral diseases. Supplementation has expanded the humeral insusceptibility of pediatric patients. When there is no pharmacological systems for counteraction or treatment are by and by accessible, for a viral sickness like COVID-19 and where the specific time

of the completion of this circumstance is obscure, nourishing approaches for improving insusceptibility is something to be investigated. In the current worldwide setting with constrained developments, it is hard to accomplish a reasonable and shifted diet. Accordingly, having suggested measures of calories and micronutrient will be a test and elective micronutrient supplementations might be useful particularly for vulnerable populaces, for example, the old (Ryan and Caplice, 2020). Late reports have introduced a solid relationship among obesity and the seriousness of COVID-19 disease, even without other co-morbidities. Subsequent to tainting the host cells, SARS-CoV-2 may cause a hyper-fieri response through the over the top arrival of cytokines, a condition perceived as "cytokine storm", while instigating lymphopenia and a disturbed insusceptible reaction. Heftiness is connected with interminable second rate irritation and insusceptible dysregulation, yet the specific systems through which it fuels COVID-19 contamination are not completely clarified, expanded measures of cytokines are created, for example, TNF- α , IL-1, IL-6 and MCP-1 lead to oxidative pressure and inadequate capacity of natural and versatile

insusceptibility, while the actuation of NLRP3 inflammasome appears to assume a basic job in the pathogenesis of the disease. The calming specialists are effectively utilized, for example, IL-1 and IL-6 blocker in comparable hyper-fieri settings like that of rheumatoid joint pain has set off the conversation of whether such operators could be administrated in chosen patients with COVID-19 ailment (Jayawardena et al., 2020).

Various nutrients (A, B6, B12, folate, C, D and E) and follow components (zinc, copper, selenium, iron) have been uncovered to have key jobs in supporting the human invulnerable framework and diminishing danger of diseases. Other basic supplements are additionally significant including different nutrients and follow components, amino acids and unsaturated fats. Every one of the supplements named above has jobs in supporting antibacterial and antiviral assurance, however zinc and selenium appear to be especially significant for the last mentioned. It would appear to be reasonable for people to devour satisfactory measures of fundamental supplements to help their invulnerable framework to assist them with managing pathogens should they become tainted. The gut miniaturized scale biota

assumes a significant job in instructing and controlling the safe framework, the element of sickness gut dysbiosis, including numerous irresistible maladies and has been portrayed in COVID-19. Dietary ways to deal with achieve a solid smaller scale biota can likewise profit the invulnerable framework. Serious disease of the respiratory epithelium can prompt intense respiratory misery disorder (ARDS), described by extreme and harming host irritation, and titled as cytokine storm (Korakas et al., 2020). Intense and constant respiratory sicknesses cause broad grimness and mortality, and this class of ailment presently incorporates the novel coronavirus serious intense respiratory disorder that is causing coronavirus ailment 2019 (COVID-19). The world is confronting a significant segment move toward a more established, hefty, and genuinely inert masses. Hazard factor appraisals dependent on pandemic information indicate that those at higher hazard for serious sickness from COVID-19 incorporate more seasoned guys, and individuals of any age with heftiness and related comorbidities, for example, hypertension and type 2 diabetes. Maturing all by itself prompts negative changes in natural and versatile resistance, a procedure called

immunosenescence. Stoutness causes foundational irritation and hurtfully impacts resistant capacity and host safeguard such that designs immunosenescence. The investigation of creature and human help the possibility that as opposed to high exercise remaining burdens, ordinary moderate-power physical action improves resistant reconnaissance against pathogens and diminishes dismalness and mortality from viral contamination and respiratory ailments including the normal cold, pneumonia, and flu. COVID-19 is certainly a reminder, a tocsin, to the world that essential avoidance countermeasures concentrated on wellbeing practices and cleanliness request our complete consideration and backing (Calder, 2020). Disappointedly, the specific pathophysiology and treatment, particularly for the extreme COVID-19, is as yet questionable. The consequences of beginning examinations have demonstrated that safe modulatory or insusceptible suppressive medicines, for example, hydroxychloroquine, interleukin (IL)-6 and IL-1 adversaries, generally utilized in rheumatology, may be considered as treatment decisions for COVID-19, especially in extreme illness. The expansion of better data about proper mitigating medicines, generally utilized

in rheumatology for COVID-19, concentrated on the auxiliary highlights of SARS-CoV-2, the host insusceptible reaction against SARS-CoV-2 and its relationship with the cytokine storm (Nieman, 2020). Obesity is a hazard and prognostic factor for the ailment seriousness and the prerequisite of cutting edge clinical consideration in COVID-19. Obesity has been associated with impeded invulnerable framework, expanding the vulnerability for 2019-nCoV disease (Nieman, 2020). Obesity is connected with metabolic unsettling influences that cause tissue pressure and brokenness. Large people are at a more serious hazard for incessant infection and regularly present with clinical parameters of metabolic disorder (MetS), insulin opposition, and foundational markers of constant poor quality irritation (Tamara and Tahapary, 2020). Typically, leptin is one of most suitable adipokines, in the focal control of vitality digestion and in the guideline of digestion resistant framework relationship assumes significant physiological jobs, being a foundation of the developing field of immune metabolism. Without a doubt, leptin receptor is communicated all through the safe framework and leptin has been shown to control both natural and versatile safe reactions (Andersen *et al.*,

2016). Leptin is truly one of most appropriate adipokines, with significant physiological jobs in the focal control of vitality digestion and in the guideline of digestion resistant framework transaction, being a foundation of the rising field of immune metabolism. Without a doubt, leptin receptor is communicated all through the resistant framework and leptin has been uncovered to manage both inborn and versatile invulnerable reactions (Francisco *et al.*, 2018).

Obesity and Inflammation

Immunologically, weight is showed as a serious illness - of a ceaseless clinical condition that can influence the invulnerable reaction to irresistible ailments through immediate, circuitous and epigenetic systems. There are numerous follower cytokines and tissues (adipokines) that are delivered and discharged with respect to the quantity of instinctive fat tissue in the body. Serum amyloid-an is an adipokine discharged by adipocytes, which can act straightforwardly on macrophages to expand their creation of provocative cytokines, for example, tumor rot factor (TnF) - α , interleukin (il) - 1, and il-6, nor do they stand up to. In fact, this article announced in detail that the vast majority of the adipokines included are non-fiery middle people. The creation of

obesity incised adipokine, for example, leptin/adiponectin builds insulin opposition in type 2 diabetes, which brings about powerlessness to distinguish and identify satiety leptin in the flawless core of the Mediobasal nerve center. Moreover, unfavorable impacts are seen, regardless of high-vitality stores, hunger, vitality consumption, exercise and vitality parity and focal insufficiency in the hippocampus - likewise, delayed iFn reactions during constant aggravation and obesogeneis incorporate compromise between the infection and weight. (Zhou et al., 2020). Coronavirus sickness (COVID-19) is a pandemic brought about by the most extreme coronavirus 2 (SARS-CoV-2) pestilence that has inundated the world, influencing more than 180 nations. Terrifically, there are a couple of significant hazard factors for genuine COVID-19 contamination. These incorporate the nearness of poor sustenance and non-transferable sicknesses (NCDs, for example, diabetes, interminable lung malady, cardiovascular ailment (CVD), stoutness, and different diseases that shield the patient from getting inoculated. These illnesses are described by fundamental aggravation, which might be a typical component of these

NCDs, influencing quiet results against COVID-19 (Zabetakis et al., 2020).

Several underlying alterations were observed in Covid-19 patients with obesity. Obesity causes alteration in pulmonary function (Popkin et al., 2020), sleep apnea, difficult mechanical ventilation and increases need of intensive care (Caussy et al., 2020). So obese individuals with covid-19 need more intention for treatment and prevention (Finelli, 2020). As per the World Obesity Federation, "weight related conditions seem to exacerbate the impacts of Covid-19 (SARS-CoV-2)"; moreover, the Centres for Disease Control and Prevention detailed that "individuals with coronary illness and diabetes are at higher hazard for SARS-CoV-2 issues and that heftiness puts them at higher danger of genuine sickness". Ongoing reports have demonstrated an expansion in cytokines because of expanded irritation in patients with SARS-CoV-2. Weight, then again, speaks to a condition of low-level injury, with an assortment of fiery items straightforwardly discharged by fat tissue (Michalakis and Ilias, 2020). A huge populace was put together examination with respect to the significance of wellbeing hazard factors (smoking, physical inertia, stoutness, and liquor addiction) COVID-19

utilizing companion information on the national clinic confirmation register. Members were 387,109 people (56.4 ± 8.8 yr; 55.1% ladies) living in England from a UK Bio bank study. Exercise, smoking, and liquor utilization, were evaluated by pattern poll (2006-2010). The weight record, from normal stature and weight, was utilized for the marker of all out corpulence. It was stated that an undesirable way of life related with a higher danger of non-transferable malady is additionally a hazard factor for admission to COVID-19, which may mostly be clarified by lower grade aggravation. Permitting a basic way of life change can lessen the danger of genuine contamination (Hamer et al., 2020). Continual aggravation, related with obesity and metabolic disorder, prompts anomalous cytokine creation and an expansion in antagonistic stage responses. Large patients have raised atomic transcript factor kappa B and high ribonucleic corrosive articulation of incendiary cytokines, for example, tumor corruption factor- α , interleukin-1, and interleukin-6 (IL-6), substances which are significant in the pathogenesis of metabolic disorder (Hotamisligil, 2006). The inborn safe reaction in patients with weight is modified and prompts a first line of guard, an expanded incendiary reaction, and a

strange T-cell reaction (Frydrych et al., 2018). Patients with high weight frequently have respiratory brokenness, described by changes in breathing examples, expanded protection from oxygen, poor gas trade and lower lung limit and muscle quality. Weight is additionally connected with an expanded danger of diabetes, coronary illness and kidney ailment, comorbidities that are considered to cause an expanded danger of renal disappointment. In any case, even without comorbidities of obesity, the immediacy of hypertension, dyslipidemia, prediabetes and insulin opposition may take a few people to cardiovascular occasions and increment the frequency of atherosclerosis, cardiovascular brokenness and disabled invulnerable capacity (Stefan et al., 2017). It is broadly realized that comorbidities, for example, hypertension, diabetes mellitus and CVD is related with a bigger COVID-19 course; weight has not been examined at this point. Obesity is a significant hazard factor for these comorbidities and particularly for the wellbeing of metabolic issue, (for example, dyslipidemia and insulin obstruction) and is connected to an expanded danger of lung infection. The estimation of anthropometric markers and metabolic

parameters is imperative to all the more likely evaluate the danger of inconveniences in patients with COVID-19 (Murugan and Sharma, 2008).

Corpulence along with lymphopenia, particularly whether specially influences to CD8 T-lymphocytes, are factors that can anticipate a poor visualization in patients with COVID-19 (Urrea et al., 2020). Aging appears to deliver a wide range of types of examples and various arrangements of obesity and age-related ailments among more seasoned grown-ups, free of their BMI, hypertension and lipid focus, an abatement in body work is obvious (known as safe senescence) prompting an expansion in speculation and shows progressively serious challenges contrasted and more youthful individuals; it shows a decay of capacity in both the obtained and inside insusceptible frameworks. In the older, numerous cells that produce cytokines / chemokines / adipokines and master incendiary go between because of irritation related harm are items inferred by ROS enhanced by lipid oxidation and development of lipid pontoons inside monocytes/macrophages. Aging is related with diminished T cell volume and number, T-cell capacity and all out number, less credulous T cells, more memory cells available for use,

thymic atrophy and decreased thymic yield and inoculated T cells. The World Health Organization (World) has recognized COVID-19 episodes and corpulence as a 'worldwide wellbeing infection'. Clinical and clinical perceptions around the globe affirm that CoVs can cause increasingly serious indications and issues in individuals with corpulence related conditions (Bastard et al., 2006; Salaniti et al., 2012).

Obesity is viewed as an unfavorable factor in the negative impacts of COVID - 19. In any case, until this point, fat tissue has not yet been completely perceived as a significant COVID infection - 19. Intense respiratory disorder coronavirus (SARS - CoV) ties with angiotensin changing over chemical 2 (ACE2) receptor of intracellular intrusion, and the instrument of intense lung injury during contamination has been hypothesized to be transmitted inside through the renin - angiotensin framework (RAS). RAS blockade has been proposed as a potential treatment for COVID - 19 (Gurwitz, 2020). Surprisingly, ACE2 is communicated in human tumors. The ACE / angiotensin II/type 1 angiotensin 2 receptor RAS pivot of activity assumes a significant job in the pathophysiology of heftiness

and the instinctive adiposity hazard related with cardiovascular infection. Association between the ACE2 - RAS framework, fat tissue, and COVID - 19 may, at any rate, clarify the generally safe of injury and mortality hazard for COVID - 19 patients with corpulence. Be that as it may, the job of ACE2 - RAS in COVID - 19 stays to be explained (Malavazos et al., 2020). Obesity can limit oxygenation by intruding on the progression of the stomach, meddling with the invulnerable reaction to expert insusceptible maladies (Honce and Schultz-Cherry, 2019) causing diabetes and oxidant stress antagonistically influencing cardiovascular capacity. In people with the most elevated prevalence of weight, COVID-19 will influence a more prominent extent of the more youthful age than recently announced. Openly sending messages to youthful grown-ups, diminishing the boundary to viral screening in obese individuals, and keeping up a more prominent familiarity with these in danger populaces ought to decrease the spread of COVID-19 (Kass et al., 2020). Proof has risen as of late with respect to the expanded danger of genuine SARS - CoV - 2 disease in corpulent patients, particularly among youngsters. Obesity is a hazard factor for entrenched

respiratory illness, and the recently announced affiliation isn't unexpected. Seeing a portion of the linkages among weight and SARS - CoV - 2 is significant, as this can help the correct administration of immunomodulatory treatment, just as improve the qualification between the individuals who need basic consideration (Watanabe et al., 2020). Increased sodium intake is directly associated with Cardiovascular diseases. High-salts consumption also increases the production of free radicals in body and reduces ACE2 expression in kidneys. Reduced ACE2 expression in directly linked with progression of infection covid-19 and its severity (Bhattacharya et al., 2020).

Nutrition Management and Precautions

In COVID-19, overweight and hefty patients have high danger of metabolic difficulties and ceaseless infections that stoutness works. More sustenance care is required for such patients (Ryan et al., 2020). Tolerant with COVID-19 create contamination from slight to serious indications bound to the dietary status. Consequently, assessing wholesome status of individuals with contamination turns out to be increasingly significant. Through dietary help, we can bring down the

danger of oxidative pressure, infection contamination and expands invulnerability framework (Laviano et al., 2020). Malnutrition is directly linked with prognosis and progression of Covid-19 and pneumonia. Both under-nourished and over-nourished individuals have equal chance of infection and its progression. Malnutrition basically causes alteration in immune function (Richter et al., 2021) which increases susceptibility to infection (Lidoriki et al., 2020). Poor dietary patterns can make worldwide weight of corpulence and diminishes physical exercises. This can be explained by: (1) increment admission of sugar, sodium, and fat. (2) More admission of high caloric eating regimen of a person. (3) Increase admission of ultra-handled food, for example, refined sugars causing change in insulin reaction, overabundance supplements stockpiling in muscle to fat ratio. (4) Ultra-handled food can changes in the cerebrum reward framework which causing addictive-like practices and overconsumption (Lidoriki et al., 2020). In addition, western eating routine (which contain bad fats that are high in cholesterol, more sugar content, salt content and diet decreased in good carbohydrates or starches, anti-oxidants containing foods, fiber and

micronutrients etc) can lead to intricacies. Wholesome administration for these patients turns out to be progressively basic in COVID-19 (Petrakis et al., 2020).

Nutrition Recommendations

Patient nutritional needs are evaluating on the basis of body weight or BMI, physiological or psychological needs and severity of infection.

Energy

As in COVID-19 more vitality required than ordinary. Keeping up vitality adjusted for heftiness and constant sicknesses is basic. As their metabolic burden is upset so low caloric can decreased the metabolic burden. Persistent with mellow to direct disease MNT includes the helpful job of essential, optional and early tertiary degrees of avoidance with the suggested measure of vitality target is 25-30 kcal/Kg/day while for fundamentally sick patients, MNT involves the gainful job generally tertiary degrees of counteraction for patients conceded in basic are with the suggested measure of vitality target will be reached to 30 kcal/Kg/day arranged in a perfect world. Standard ICU takes care of are arranged hypocaloric (0.8kcal/mL) for inception, advancing to iso-caloric (1kcal/mL) and hypercaloric (up to 1.5kcal/mL).

Fats

For mellow to extreme and basically sick patients the suggested measure of fat are 25-30% of the all-out vitality, undeniably arranged thinking about fat ingestion and digestion. It is suggested that the day by day intravenous lipid (counting non-healthy lipid wellsprings) of fat is 1g/Kg, and the most extreme isn't more than 1.5 g/Kg, and it should be balanced by singular resilience for such patients which have imbalanced of intravenous infusion of fat can prompt lipid overburden and harmfulness causing hypertriglyceridemia and unusual liver capacity. To improve oxidative use of unsaturated fats utilization of medium and long chain unsaturated fats is liked. Utilize monounsaturated unsaturated fats and for the most part omega-3 unsaturated fats are utilized for basic sick patients. It can diminish the danger of disease and make quick recuperation. Omega-9 unsaturated fats ought to be suggested (olive oil) in light of the fact that have elements of safe unbiased impacts and furthermore less obstruction with haemo-elements, endothelial cell work, safe capacity and liver capacity.

Fluid and electrolyte balance

To keep up liquid and electrolyte adjusted (Sodium, calcium, potassium,

chloride, phosphate, and magnesium), the "Four-Anti and Two-Balance" technique characterized as antivirus, hostile to stun, against hypoxaemia, against optional disease, and keeping up of water, electrolyte and corrosive base equalization and microecological balance is a powerful treatment methodology. Suggested measure of liquid treatment are 30 to 40 mL/Kg/day balanced regarding internal heat level, aspiratory oedema, renal brokenness and liquid aggregation. For stable patients in ICU: 30 mL/Kg/day of liquid for grown-up and 28 mL/Kg/day for older (Gupta et al., 2020).

Protein

It is suggested 1.3 g/Kg/day expanding the gracefully of stretched chain amino acids to half. Tolerant with ceaseless entanglements, for example, corpulence or renal issue properly lessen protein admission to 0.8-1.0 g/Kg/day. Great protein quality with expanded chain amino acids (BCAA) supplements, whey protein and other creature proteins ought to be incorporated. In serious conditions supplemental intravenous amino corrosive imbuements required and furthermore withstand positive protein balance.

Carbohydrates

Fat and sugars are acclimated with vitality requirements although seeing a vitality proportion through fat and starches among 30:70 (without breathing insufficiency) to 50:50 % (critical condition patients) with nonstop unique observing and upgrading blood glucose levels. Constrained organization of sugars in basic sick patients the starch prerequisite is 2 g/Kg/day and must not surpass 150 g for each day (Romano et al., 2020).

Micronutrients

For all degrees of anticipation in COVID-19 patient different micronutrient supplementation, other than vitamin A, B, C and D and omega-3 polyunsaturated fats, just as selenium, zinc and iron are suggested.

Vitamin D

Patient with stoutness and furthermore have COVID-19 may add to vitamin D lack (<20 ng/mL) and additionally connected with number of various viral sicknesses and end of the week safe framework also. The organically dynamic type of vitamin D (1,25-dihydroxyvitamin D/calcitriol) has been related in different fiery, irresistible, and pneumonic maladies. Nutrient D through daylight presentation, certain eating bases may

give a specific measure of vitamin D, containing the sustained grains and dairy products. The objective ought to be to increase the groupings of 25(OH)D over 40–60 ng/mL (100–150 nmol/l) by thinking about taking 10,000 IU/d of vitamin D3 for half a month to quickly increase 25(OH)D focuses, trailed by 5000 IU/d for individuals in danger of COVID-19.

Vitamin A

Vitamin A is hostile to infective nutrient and capacity to have body resistances against disease. The advancement of mucins and keratins, lymphopoiesis, apoptosis, cytokine articulation, counter acting agent creation, and the upgraded elements of neutrophils, regular executioner cells, monocytes or macrophages, T cells, and B cells are the insusceptible supporting jobs of vitamin A.

Vitamin C

Vitamin C has insusceptible tweaking impact and it can diminish complexities. In basic sick patients constrained proof shows that high-portion vitamin C (3~10 g/d) intravenous infusion might be helpful to lessen mortality, cut the utilization of promoter drugs and mechanical ventilation time, and incorporate intense respiratory trouble.

Selenium

Selenium has cancer prevention agent property and through cell reinforcement it can assume a basic job in the barrier against viral disease, redox flagging, and redox homeostatic commitments. A few selenoproteins are glutathione peroxidases and thioredoxin reductases decline the pathogenicity of a few infection contaminations.

Zinc

For typical capacity and improvement of cells controlling vague invulnerability, including characteristic executioner cells and neutrophils zinc is a basic micronutrient with enzymatic and the translation guidelines capacities acted in the human body. Advancement of gained invulnerability by restricting together the definite and development elements of T lymphocytes containing the creation as well as actuation of Th1 cytokine adjusts by zinc lack. Zinc has hostile to viral property and improves invulnerable reactions. In this way, the utilization of 50 mg zinc daily might give a defensive job in contradiction of the COVID-19 pandemic (Gasmi et al., 2020).

Supplements

Oral wholesome enhancements (ONS) ought to be utilized if there is patient need raised. ONS will give in

any event 400 kcal/day containing 30 gram or else a greater amount of protein per day and will be there proceeded on behalf of in any event one month (Barazzoni et al., 2020). Maxvida, Ensure Plus, Hinx HP, Prohance HP, Frezubin Plus are different healthful enhancements with fatty, high protein and wealthy in micronutrients joined with oral eating routine just as utilized in EN. These enhancements are all calorie-supplement thick details, planned explicitly for addressing nourishing requirements of fundamentally sick patients. Additionally probiotics and prebiotics with wholesome help supplemented may assist with improving gastrointestinal capacity, manage the parity of intestinal miniaturized scale biota, and defeat the danger of auxiliary contamination in light of bacterial translocation in this way boosting resistance.

Physical activity

Being genuinely dynamic and should exercise or walk day by day for at any rate 30 minutes is especially suggested in this circumstance and furthermore keep up overweight and wellness level. Expansion of dietary fiber and supplements in your eating routine controlling the vitality digestion can help in weight the board just as decrease of glycaemic spikes.

- During shopping for food keep up a separation of in any event 1 meter from others.
- Don't touch face in the wake of interacting with outside articles.
- Wash products of the soil, milk parcels before use.
- Limit exceptionally prepared nourishments.
- Ensure safe cooking rehearses at home.
- Wash hands oftentimes with cleanser and water extraordinarily before giving crude, cooked.
- Always wash utensils and plates before use
- Avoid giving food on the off chance that you are sick.
- Refrigerate left-over food right away.
- Keep sanitation as a main priority while putting away food (Gupta et al., 2020).

Obesity and covid-19 epidemics can also be reduced by improving food industry. As it has been explored that food industry is one of the main reasons behind obesity pandemic (Robinson et al., 2021). During this covid-19 pandemic, food industries promoted the production of unhealthy ready to eat foods for their own profit. Food industries promote processed foods consumption, loaded with sugar, salts and empty calories (Roganović, 2021). These processed foods also increase obesity and susceptibility to infection. Food industries should prohibit the production of unhealthy foods and drinks. Governments around the world must stop the unhealthy foods productions at industry level and must ensure food security/food availability for all (Tan et al., 2020).

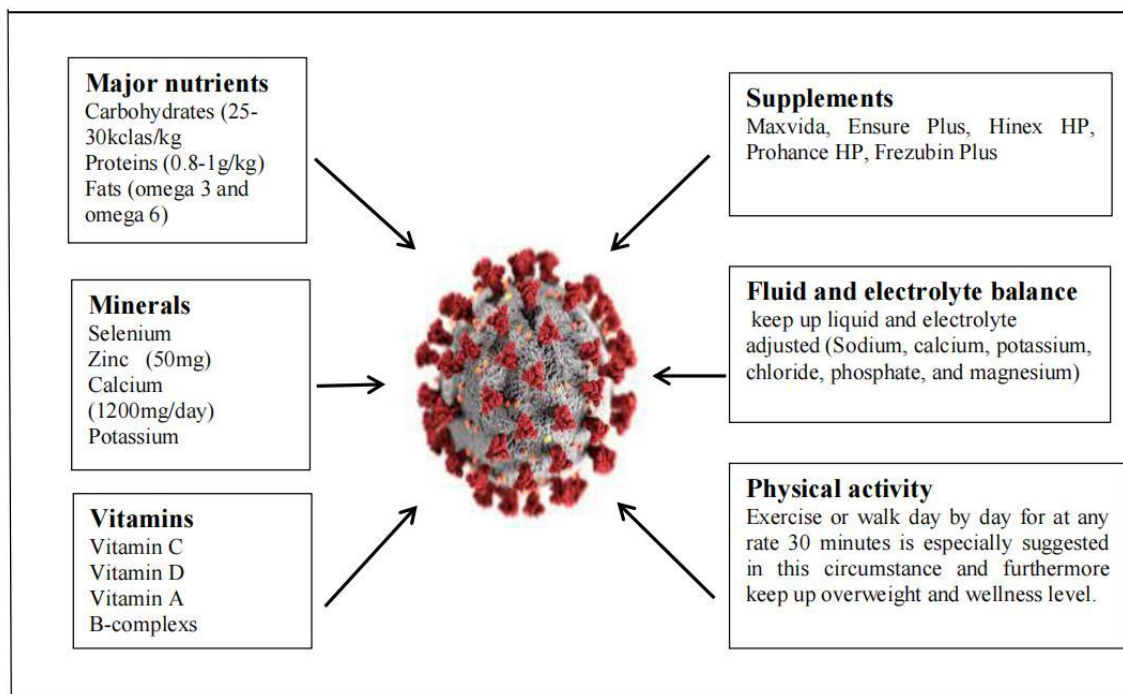


Fig. 2: Medical nutrition therapy for COVID-19

CONCLUSION

The effect of obesity on COVID-19 is not yet clearly visible but severity of disease is noticed in the patients with obesity or severe obesity. Infection spreads rapidly in obese patients as compared to the one with healthy weight. Obesity along with other metabolic disease increase inflammation and cause hindrance in recovery. Presence of fat tissues in obese person also reduces the immunity level. Studies show that the disease get severe with the increase in BMI. Obesity can be counted as a risk factor for COVID-19 and obese patient needs extra care, attention and preventive measure to fight with this pandemic.

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