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Oral Manifestations Associated With COVID-19

A research submitted to the department of oral and maxillofacial surgery , in the college of dentistry , university of Babylon ,as a partial requirement of degree of Bachelors (B.D.S)

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الإهداء الى:

إلى الينبوع الذي لا يمل العطاء و إلى مَن حاكت سعادتي بخيوطٍ منسوجةٍ مِن قلبها ... **أُمي العزيزة**

إلى مَن سعى و شقيَّ لأنعم بالراحةِ و الهناءِ الذي لم يبخل ب شيءٍ مِن أجلِ دفعي في طريقِ النجاح الذي علمني أن أرتقي سُلم الحياة بحكمةٍ و صبرٍ ... **والدي العزيز**

إلى مَن سِرنا سوياً و نحن نشق الطريق معاً نحو النجاح و الإبداع إلى مَن تكاتفنا يداً بيد و نحن نقطِفُ زهرة تعلمنا ... **صديقاتي العزيزات**

إلى مَن علموني حروفاً مِن ذهبٍ و كلماتٍ مِن دُرر و عباراتٍ مِن أسمى و أجلى عبارات العلم إلى مَن صاغو مِن علمهم حروفاً و مِن فكرهم منارةً تنير لنا مسيرة العلم و النجاح ... **أساتذتي الكرام**

شكر وتقدير

قال تعالى (ومن يشكر فإنما يشكر لنفسه){لقمان:12}

وقال رسوله الكريم :"من لم يشكر الناس ، لم يشكر الله عز وجل"

نحمد الله حمدا كثيرا على ما أكرمنا به من إتمام هذه الدراسة راجية مِن المولى عز و جل أن يجِد القبول و النجاح ثم أتوجه بجزيلِ الشكرِ و الإمتنان إلى:

الدكتور الفاضل (ميثم رياض علي) لتفضله بالإشراف على هذه الدراسة و نصحنا و التوجيه للإتمام

الباحثات

- **أصيل حسين كاظم**
- **آية قاسم غضيب**
- **دعاء علاء جودت**
- **فاطمة صادق محسن**
- **نور حسين علي**

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Introduction

The World Health Organization (WHO) has declared the coronavirus disease 2019 (COVID-19) a pandemic. A global coordinated effort is needed to stop the further spread of the virus. A pandemic is defined as "occurring over a wide geographic area and affecting an exceptionally high proportion of the population [(1)] .

COVID-19 is a pathogenic virus. From the phylogenetic analysis carried out with obtainable full genome sequences, bats occur to be the COVID19 virus reservoir, but the intermediate host(s) has not been detected till now. Though three major areas of work already are ongoing in [(2)] . China to advise our awareness of the pathogenic origin of the outbreak. These include early inquiries of cases with symptoms occurring near in

Wuhan during December 2019, ecological sampling from the Huanan Wholesale Seafood Market as well as other area markets, and the collection of detailed reports of the point of origin and type of wildlife species marketed on the Huanan market and the destination of those animals after the market has been closed.

For about 18,738,58 laboratory-confirmed cases recorded as of 2nd week of April 2020, the maximum number of cases (77.8%) was between30 and 69 years of age. Among the recorded cases, 21.6% are farmers or employees by profession, 51.1% are male and 77.0% are Hubei [(3)] . The first case of covid-19 was confirmed in Iraq on the 24th of February 2020, which was of an international student who travelled recently to Iraq.

All COVID-19 cases in Iraq were linked to foreign visits with few local transmissions to close contacts without community transmission. The majority of cases were mild illnesses with full recovery.

Coronaviruses mostly cause gastrointestinal and respiratory tract infections and

are inherently categorized into four major types: Gamma coronavirus, Delta coronavirus, Beta coronavirus and Alpha coronavirus . The first two types mainly infect birds, while the last two mostly infect mammals [(4)(5)].

The transmission of COVID-19 is the passing of coronavirus disease 2019 from person to person. COVID-19 is mainly transmitted when people breathe in air contaminated by droplets/aerosols and small airborne particles containing the virus. Infected people exhale those particles as they breathe, talk, cough, sneeze, or sing [1][2][3][4]. Transmission is more likely the more physically close people are. However, infection can occur over longer distances, particularly indoors [1][5] .

COVID-19 has two routes of transmission as the fig (1) , either directly or indirectly. It can be transmitted indirectly through saliva, while it may be spread directly by coughing, sneezing, and droplet inhalation or via direct contact with oral, nasal, and ocular mucous membranes People remain contagious for up to 20 days, and can spread the virus even if they do not develop symptoms Coronavirus attacks human cells by angiotensin converting enzyme 2 (ACE2) receptors since the current evidence indicated that ACE2 acts as the primary host cell receptor for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; Zou et al., 2020). As such, the virus will bind to ACE2 using the spike-like protein on its surface**,** and ACE2 will serve as a cellular portal for viral entry into the cell to cause COVID-19 infection (Ciaglia et al., 2020).

Hence, organs with high ACE2 expression (e.g., lung) can become target cells during SARS-CoV-2 infection that cause inflammatory reactions in related organs and tissues, such as salivary glands and tongue, which could explain the occurrence of both loss of taste and oral ulceration due to destruction of keratinocytes and oral fibroblasts (Zhou et al., 2020).

Otherwise, high viral load in the saliva and nasal secretion can be a pathogenic factor involved in developing the oral changes associated with COVID-19 infection, which indicates the direct effect of the virus on the oral tissues In some people, COVID-19 causes people to temporarily lose their sense of smell either partially or fully [6][7] .

This symptom, if it is present at all, often appears early in the illness. [6]

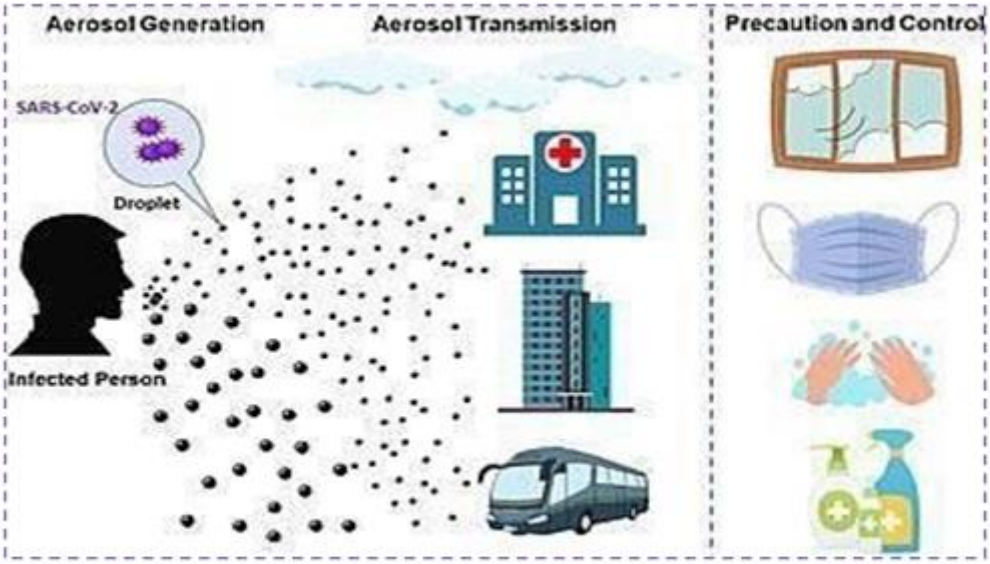

Fig (1) Transmission COVIDA – 19

Its onset is often reported to be sudden. Smell usually returns to normal within a month. However, for some patients it improves very slowly and is associated with odors being perceived as unpleasant or different than they originally did (parasomnia), and for some people smell does not return for at least many

months. it is believed that these symptoms are caused by infection of Sustentacular cells that support and provide nutrients to sensory neurons in the nose, rather than infection of the neurons themselves. Sustentacular cells have many Angiotensin converting enzyme 2 (ACE2) receptors on their surfaces, while olfactory sensory neurons do not. Loss of smell may also be the result of inflammation in the olfactory bulb . [7] [8][9]

Several testing methods have been developed to diagnose the disease .The standard diagnostic method is by detection of the virus's nucleic acid by real-time reverse transcription polymerase chain reaction (rRTPCR), transcription-mediated amplification (TMA), or by reverse transcription loop-mediated isothermal amplification (RT-LAMP) from anaso pharyngeal swab.

the world reported disease spread caused by aerosol penetration into the upper therespiratory tract and lungs via inhalation(10)(11)(12) . There followed a rapid growth in the number of cases all around the world. A mathematical model examined whether the control of SARS-COV-2 infection could be achieved by isolating affected patients, and tracking their contacts with other individuals.

This model concluded that isolating people and reviewing their contacts would be insufficient to control the COVID-19 pandemic within three months, because there would be too much delay between the onset of symptoms and isolation Thus, observing preventive measures, especially isolation and lockdown, would be essential . (13)(14)(15)

SARS-COV-2 is highly contagious, and there has not yet been any vaccine or effective treatment that has received approval . So, the best solution for controlling the pandemic will be the simultaneous application of preventive methods, sensitive diagnostic approaches, and using current available drugs, while still developing novel treatments .This study presents the latest Information about COVID-19 transmission, prevention Symptoms

Symptoms

The symptoms of COVID-19 are variable as fig (2) , ranging from mild symptoms to critical and possibly fatal illness [1][2] . Common symptoms include coughing, fever, loss of smell (anosmia) and taste (ageusia), with less common ones including headaches, nasal congestion and runny nose, muscle pain, sore throat, diarrhea, eye irritation [3] , and toes swelling or turning purple [4] , and in moderate to severe cases breathing difficulties [5] . People with the COVID-19 infection may have different symptoms, and their symptoms may change over time. Three common clusters of symptoms have been identified: one respiratory symptom cluster with cough, sputum, shortness of breath, and fever; a musculoskeletal symptom cluster with muscle and joint pain, headache, and fatigue; a cluster of digestive symptoms with abdominal pain, vomiting, and diarrhea [5] .In people without prior ear, nose, and throat disorders, loss of taste combined with loss of smell is associated with COVID-19 and is reported in as many as 88% of symptomatic cases [10][11][12] .

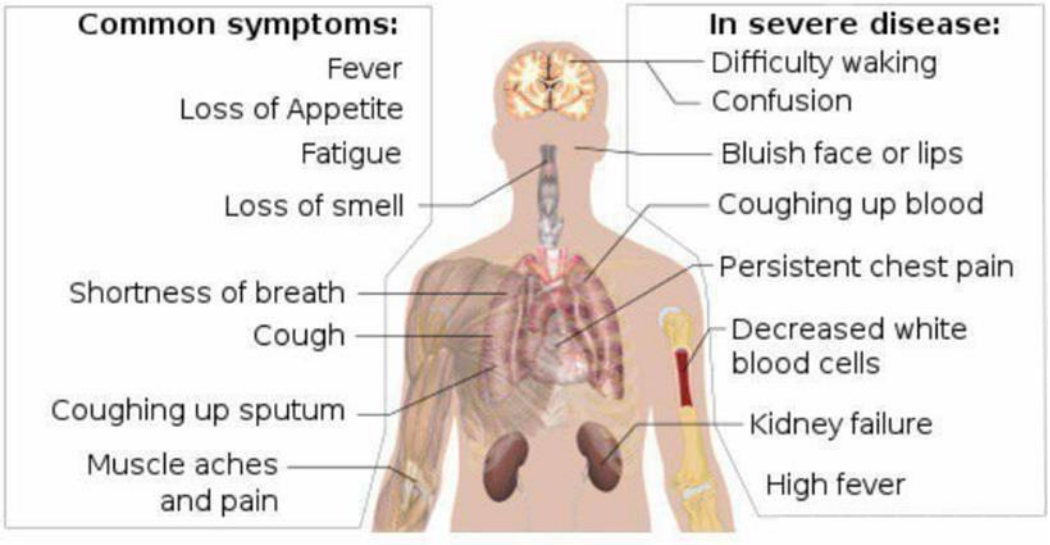

Fig (2) SYMPTOMS

Taste

The sense of taste affords an animal the ability to evaluate what it eats and drinks. At the most basic level, this evaluation is to promote ingestion of nutritious substances and prevent consumption of potential poisons or toxins. There is no doubt that animals, including humans, develop taste preferences. That is, they will choose certain types of foodin preference to others. Interestingly, taste preference often changes in conjunction with body needs. Similarly, animals often develop food aversions, particularly if they become ill soon after eating a certain food,eventhough that food was not the cause of the illness - surely you have experienced this yourself. Food preferences and aversions involve the sense of taste, but these phenomena are almost certainly mediated through the central nervous system.

Taste Receptor Cells, Taste Buds and Taste Nerves The sense of taste is mediated by taste receptor cells which are bundled in clusters called taste buds. Taste receptor cells sample oral concentrations of a large number of small molecules and report a sensation of taste to centers in the brainstem.

In most animals, including humans, taste buds are most prevalent on small pegs of epithelium on the tongue called papillae. The taste buds themselves are too smallto see without a microscope, but papillae are readily observed by close inspection of the tongue's surface. To make them even easier to see, put a couple of drops of blue food coloring on the tongue of a loved one, and you'll see a bunch of little pale bumps - mostly fungiform papillae - stand out on a blue background.

Taste buds are composed of groups of between 50 and 150 columnar taste receptor cells bundled together like a cluster of bananas. The taste receptor cells within a bud are arranged such that their tips form a smalltaste pore, and through this pore extend microvilli from the taste cells.

The microvilli of the taste cells bear taste receptors .Interwoven among the taste

cells in a taste bud is a network of dendrites of sensory nerves called "taste nerves".

When taste cells are stimulated by binding of chemicals to their receptors, they depolarize and this depolarization is transmitted to the taste nerve fibers resulting in an action potential that is ultimately transmitted to the brain. One interesting aspect of this nerve transmission is that it rapidly adapts - after the initial stimulus, a strong discharge is seen in the taste nerve fibers but within a few seconds, that response diminishes to a steady state level of much lower amplitude.

Once taste signals are transmitted to the brain, several efferent neural pathways are activated that are important to digestive function . For example, tasting food is followed rapidly by increased salivation and by low level secretory activity in the stomach.

Among humans, there is substantial difference in taste sensitivity. Roughly one in four people is a "supertaster" that is several times more sensitive to bitter and other tastes than those that taste poorly. Such differences are heritable and reflect differences in the number of fungiform papillae and hence taste buds on the tongue.

In addition to signal transduction by taste receptor cells, it is also clear that the sense of smell profoundly affects the sensation of taste. Think about how tastes are blunted and sometimes different when your sense of smell is disrupted due to a cold.

Taste Sensations

The sense of taste is equivalent to excitation of taste receptors, and receptors for a large number of specific chemicals have been identified that contribute to the reception of taste. Despite this complexity, five types of tastes are

commonly recognized by humans:

- **Sweet - usually indicates energy rich nutrients**
- **Umami - the taste of amino acids (e.g. meat broth or aged cheese)**
- **Salty - allows modulating diet for electrolyte balance**
- **Sour - typically the taste of acids**
- **Bitter - allows sensing of diverse natural toxins None of these tastes areelicited by a single chemical.**

Also, there are thresholds for detection of taste that differ among chemicals that taste the same. For example, sucrose, 1-propyl -2 amino- 4nitrobenzene and lactose all taste sweet to humans, but the sweet taste is elicited by these chemicals at concentrations of roughly 10 mM, 2 uM and 30 mM respectively - a range of potency of roughly 15,000-fold. Substances sensed as bitter typically have very low thresholds.

Taste Receptors

A very large number of molecules elicit taste sensations through a rather small number of taste receptors. Furthermore, it appears that individual taste receptor cells bear receptors for one type of taste. In other words, within a taste bud, some taste receptor cells sense sweet, while others have receptors for bitter, sour, salty and umami tastes. Much of this understanding of taste receptors has derived from behavioral studies with mice engineered to lack one or more taste receptors as fig (3) .

The pleasant tastes (sweet and umami) are mediated by a family of three T1R receptors that assemble in pairs. Diverse molecules that lead to a sensation of

sweet bind to a receptor formed from T1R2 and T1R3 subunits. Cats have a deletion in the gene for T1R2, explaining their nonresponsiveness to sweet tastes. Also, mice engineered to express the human T1R2 protein have a human-like response to different sweet tastes. The receptor formed as a complex of T1R1 and T1R3 binds Lglutamate and L-amino acids, resulting the umami taste.

The bitter taste results from binding of diverse molecules to a family of about 30 T2R receptors. Sour tasting itself involves activation of a type of TRP (transient receptor potential) channel. Surprisingly, the molecular mechanisms of salt taste reception are poorly characterized relative to the other tastes.

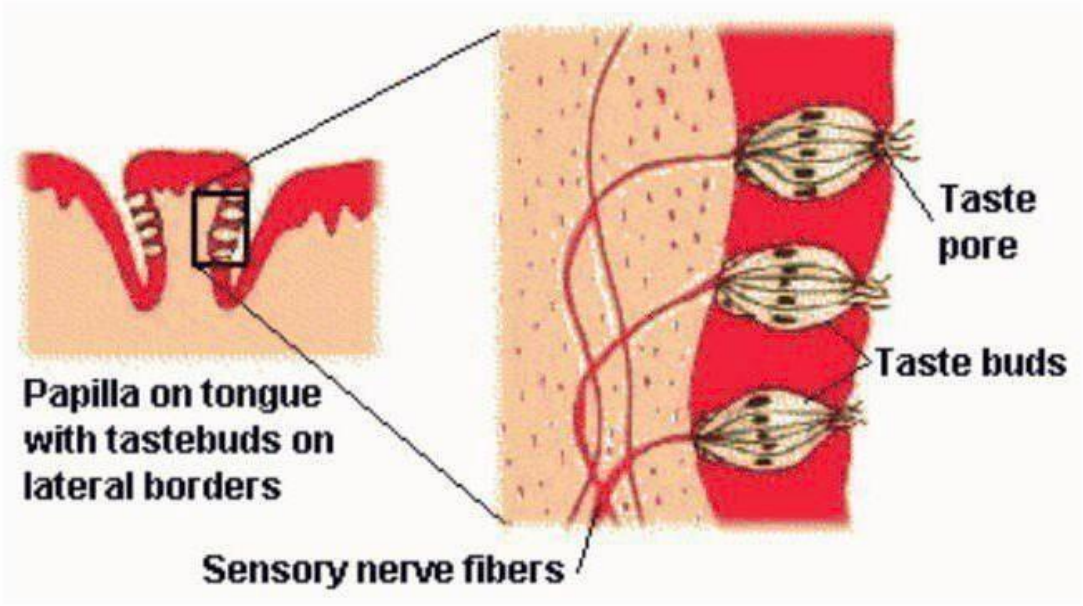

Fig (3) Test receptor

Olfaction (Smell)

Like taste, the sense of smell, or olfaction, is also responsive to chemical stimuli. The olfactory receptor neurons are located in a small region within the superior nasal cavity This region is referred to as the olfactory epithelium and contains bipolar sensory neurons. Each olfactory sensory neuron has dendrites that extend from the apical surface of the epithelium into the mucus lining the cavity. As airborne molecules are inhaled through the nose, they pass over the olfactory epithelial region and dissolve into the mucus. These odorant molecules bind to proteins that keep them dissolved in the mucus and help transport them tothe olfactory dendrites. The odorant–protein complex binds to a receptor protein within the cell membrane of an olfactory dendrite. These receptors are G protein–coupled, and will produce a graded membrane potential in the olfactory neurons.

The axon of an olfactory neuron extends from the basal surface of the epithelium, through an olfactory foramen in the cribriform plate of the ethmoid bone, and into the brain. The group of axons called the olfactory tract connect to the olfactory bulb on the ventral surface of the frontal lobe. From there, the axons split to travel to several brain regions. Some travel to the cerebrum, specifically to the primary olfactory cortex that islocated in the inferior and medial areas of the temporal lobe. Others project to structures within the limbic system and hypothalamus, where smells become associated with long-term memory and emotional responses. This is how certain smells trigger emotional memories, such as the smell of food associated with one's birthplace. Smell is the one sensory modality that does not synapse in the thalamus before connecting to the cerebral cortex. This intimate connection between the olfactory system and the cerebral cortex is one reason why smell can be a potent trigger of memories and emotion.

The nasal epithelium, including the olfactory cells, can be harmed by airborne toxic chemicals. Therefore, the olfactory neurons are regularly replaced within the nasal epithelium, after which the axons of the new neurons must find their appropriate connections in the olfactory bulb.

These new axons grow along the axons that are already in place in thecranial nerve. Olfactory system, the bodily structures that serve the sense of smell. The system consists of the nose and the nasal cavities, which in their upper parts support the olfactory mucous membrane for the preception of smell and in their lower parts act as respiratory passages.

The bony framework of the nose is part of the skull, but the outer nose is supported only by bone above; lower down, its shape is kept by cartilaginous plates. The expanded lower part of the side of the nose, the ala, is formed only of skin, both externally and internally, with fibrofatty tissue between the layers. The nasal cavities are separated by a septum covered in its lower two-thirds by thick, highly vascular mucous membrane composed of columnar ciliated epithelium with masses of acinous glands embedded in it, while in its upper part it iscovered by theless vascular but more specialized olfactory membrane. Near the front ofthe lower part of the septum a slight opening into a short blind tube, which runs upward and backward, may sometimes be found; this is the vestigial remnant of Jacobson's organ. The supporting framework of the septum is made up of ethmoid above, vomer below, and the septal cartilage in front. The outer wall of each nasal cavity is divided into three meatuses bythe overhanging turbinated bones. Above the superior turbinated bone is a space between it and the roof known as the recessuss phenoethmoidalis, into the back of which the sphenoidalair sinus opens. Between the superior and middle turbinated bones is the superior meatus, which contains the openings of the posterior ethmoidal air cells, while between the middle and inferior turbinated bones is the middle meatus, which is the largest of the three and contains a rounded elevation, the bulla ethmoidalis. Above and behind this is often an opening for the middle ethmoidal cells; below and in front runs a deep sickle-shaped gutter, the hiatus semilunaris, which communicates above with the frontal air sinus and below with the opening into the antrum of Highmore or maxillary antrum. The inferior meatus is below the inferior turbinated bone, and, when that is lifted, the valvular opening of the nasal duct is seen.

The roof of the nose is narrow, and it is here that the olfactory nerves pass in through the cribriform plate. The floor is wider so that a coronal section through each nasal cavity has roughly the appearance of a right-angled triangle.

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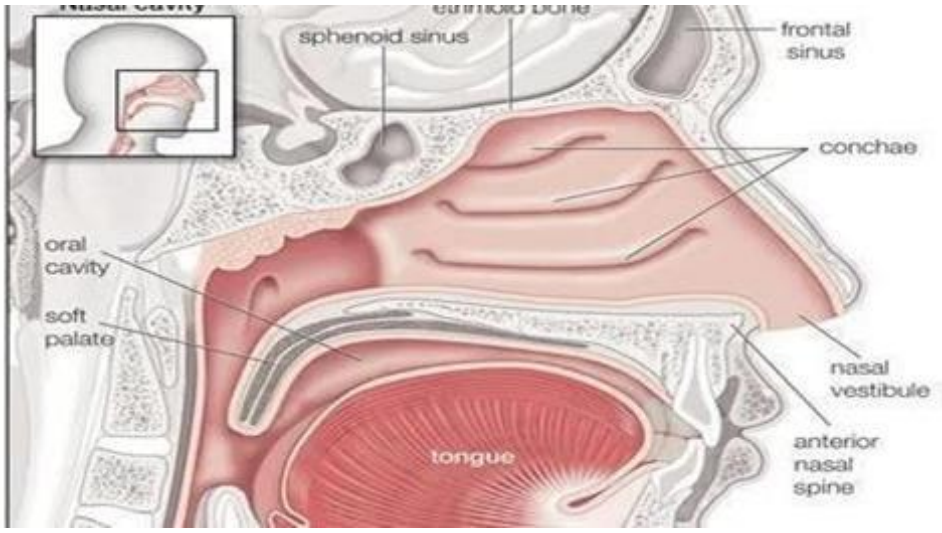

Fig (4) Nasal Cavity

Materials and Methods

Coronaviruses are important human and animal pathogens. At the end of 2019, a novel coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan, a city in the Hubei Province of China. Today we present an observational descriptive study of Covid-19 patients (from 1 year to 70 years of age) with confirmed SARS-CoV-2 infection from 1st of December and concluded in mid-March. Some samples are excluded include very young age patients and patients who were asymptomatic from many different sources(Babylon university college of dentistry, Imam Al_Sadeq hospital, relatives, electronic link and paper questionnaire) The paper questionnaire included • (Name, Age, occupation, gender) • Date of Corona Virus (Covid-19) infection • Period of time the infection took till healing Treatment(azithromycin , analgesics , vitamin supplements , vancomycin , convalescent plasma
,bronchodilator , antipyretic and others). Some other systemic diseases include (diabetes , hypertension, epilepsy, renal and hepatic diseases and others) and the most importantly the oral manifestations associated with Covid-19 such as (Taste,smell,teeth,TMJ and oral mucosa) Certain laboratory investigation to confirm the infection included (PCR , X-ray and others) Also included whether the patient took Covid-19 vaccine or not and the type of vaccine been used Last but not least, whether the patient been hospitalized or not Our report have shown the important events leads to increase the number of people who had had lost their taste and smell scenes , the most infected age group and gender.

Results:

One hundred ninety four patients involved in these study (41) patients 28.6% were males and 143 were females (71.4%).

The age range of male patients was (11-67) years and the mean ±SD was (30±13.5) years, while the female patients the range was (13-80) year, the mean age was (27.6±11) years (table 1) .

Age	Male (28.6%)	Female (71.4%)
Range (years)	11-67	13-80
Mean±SD (years)	30.8±13.5	27.6±11

Table 1

The highest number of patient male was 23 years about 9 patients (22.5%), as in figure (5) .

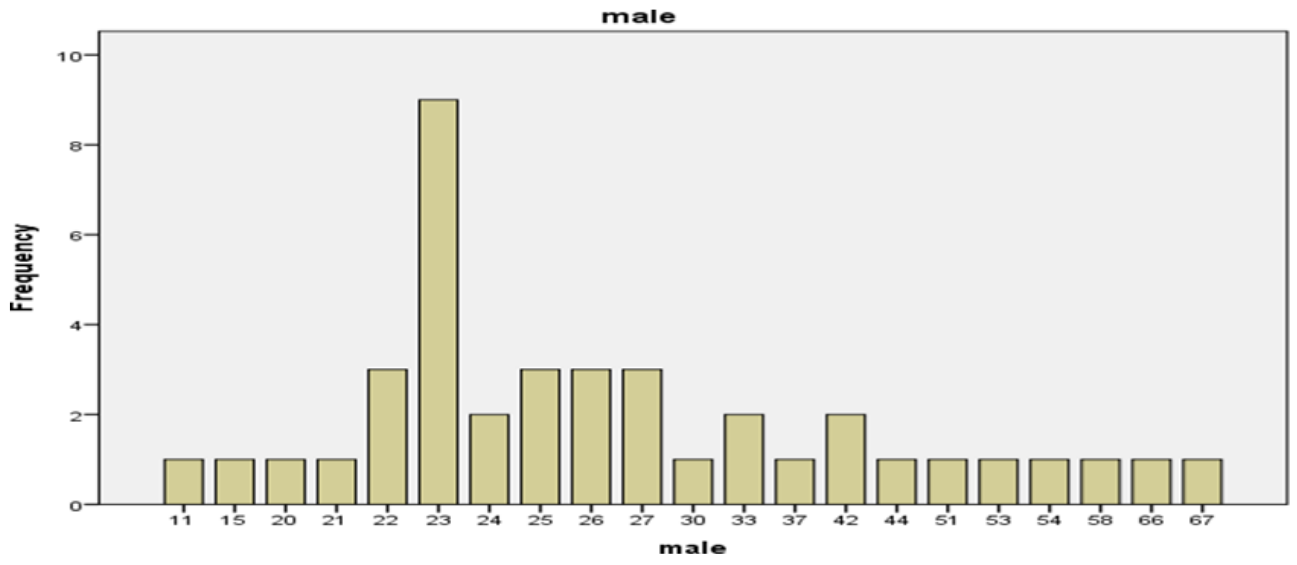

Fig (5) male Frequency

The highest number of patient female was 22 years about 28 patients(19.6%), as in figure 6 .

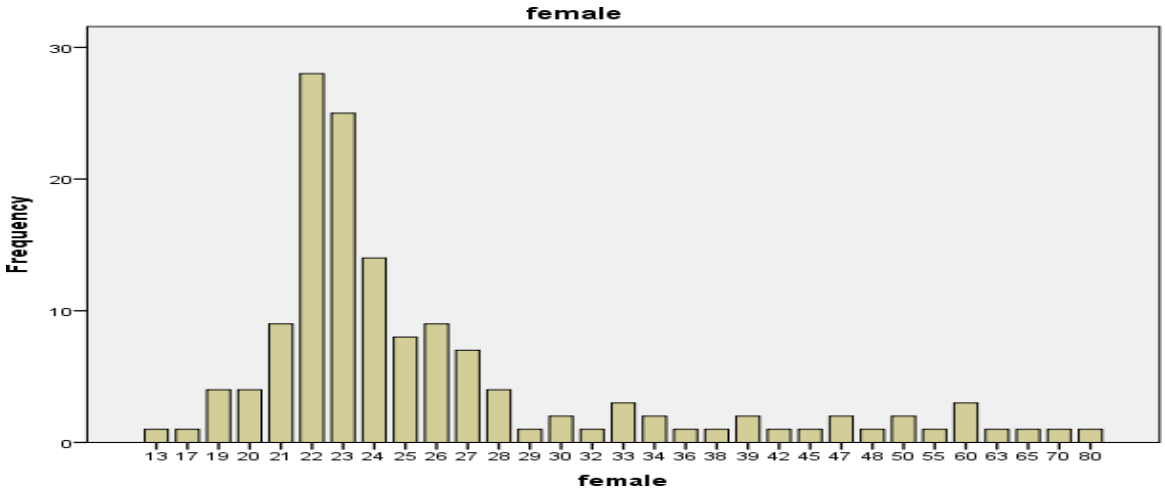

Fig (6) Female Frequency

No significant differences (p value 0.12) were found between male and female patients according to age mean as in table (2).

Age	Patients 194 (100%)
Male (mean age)	30.5 years
Female (mean age)	27.5 years
T	1.17
P value	0.12

Table (2) T-Test for age mean between male and female patients

Chi square shows highly significant differences between number of male and female patients, (p value 0.00) table 3 .

Gender	COVID patients194 (100%)
Male	41(28.6%)
Female	143(71.4%)
X^2	153,**
P value	0.000

Table (3) chi square-Test for sex between patients

There was a highly significant difference between male and female patients according to loss of smell and smell with test (p value .006 and .000) respectively ,while no differences found between them according to loss of test. (Table 4).

Paired Samples Test								
Paired Differences						t	df	Sig. (2-tailed)
Mean		Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Maletest –femaletest	-1.9	23.48	5.536	-13.624	9.735	-.35	17	.730
Maletest –femaletest	13.8	13.64	3.216	7.103	20.675	4.31	17	.000
Maletest –femaletest	12.3	15.43	3.860	4.086	20.539	3.19	15	.006

Table 4 **Paired Samples Test**

Discussion

The conclusions that can be drawn from this study are as follows:

In March 8, 2022 (PAHO)- The COVID-19 pandemic had a disproportionate impact on women in the Americas, contributing to increased gender inequality in health and threatening women's development and well-being.
During the pandemic, the role of caregiver exposed women to an increased risk of contracting COVID-19. Comprising the vast majority of healthcare workers, women were on the front line caring for patients and accounted for 72% of all COVID-19 cases among healthcare professionals in the region.
Otherwise, In our study samples taken for females more than samples of males, So it can be affected.
The results of the study shows that the highest infection rate is between(20-30)for males and females, Because of higher levels of smoking and drinking among young people as compared to older.

Additionally, old people have more responsible attitude toward the Covid-19 pandemic than younger ones This may reversibly affect the undertaking of preventive measures such as frequent hand washing, wearing of face mask, and stay at home orders.
According to our study there is a difference between males and females in loss of smell and smell with taste. About taste, no difference found between them.

Gustatory and olfactory changes can be the only symptom in mild cases of Covid-19 or the initial symptom in patients who ultimately present with more severe respiratory failure. The reported gustatory changes associated with Covid-19 are hypogeusia, dysgeusia and ageusia. The exact pathogenesis of SARS-CoV-2 and olfactory and gustatory dysfunction is not known. It is reported that angiotensin-converting enzyme 2 (ACE2) cell receptors are expressed in abundance on respiratory epithelium and oral mucosa especially tongue. SARS-CoV-2 has a great affinity for these receptors. Direct damage to nasal and oral epithelium and neuroinvasive nature of this virus can result in olfactory and gustatory disorders.
It is reported that 95% of the cases with taste disturbances are secondary to olfactory dysfunction. Olfactory dysfunction should be considered as a primary cause if patient complaints of both smell and taste disturbances.

Most of the studies had considered smell and taste disturbances as a single entity rather than two separate entities. In fact, it is often very difficult for the patient to delineate between taste and smell dysfunctions. There is a need to highlight Covid-19 cases presented with gustatory dysfunction (hypogeusia, dysgeusia and ageusia) in the absence of olfactory changes. Investigations such as whole mouth and spatial taste tests can be employed to identify the

presence of gustatory dysfunctions along with localization of area of impairment and threshold sensitivity to a particular taste .

Based on the frequent presence of these symptoms in Covid-19 positive and suspected patients, the American Academy of Otolaryngology recommended the addition of anosmia, hyposmia, and dysgeusia to the list of screening tools for COVID-19 in asymptomatic individuals. The US Centers for Disease Control and Prevention officially added olfactory and gustatory dysfunctions as an important Covid-19 symptom whereas the WHO listed them as less common symptoms of Covid-19.

Researchers also discovered that infected people could lose their sense of taste and their ability to detect chemically triggered sensations such as spiciness, called chemesthesis.
Almost a year later, some still haven't recovered these senses, and for a proportion of people who have, odors are now warped: unpleasant scents have taken the place of normally delightful ones. Nature surveys the science behind this potentially long-lasting and debilitating phenomenon.

Although the mechanisms are not fully understood, there is an emerging consensus that smell loss occurs when the coronavirus infects cells that support neurons in the nose.
When researchers first identified smell loss as a symptom of COVID-19, they were worried that the virus was infecting the odor-sensing neurons in the nose that send signals to the olfactory bulb in the brain — and that the virus could therefore access the brain. However, post-mortem studies4 of people who had had COVID-19 have shown that the virus rarely reaches the brain.
A team led by Sandeep Robert Datta, a neurobiologist at Harvard Medical School in Boston, Massachusetts, has instead found5 that cells that support sensory neurons in the nose — known as sustentacular cells — are probably what the virus is infecting.

Recommendation

COVID-19 spreads primarily from person to person. Fighting this disease is our joint responsibility. Protect yourself and others by making these 6 simple precautions your new habits :

1-Wear a mask
Everyone 2 years and older should wear masks in public Masks should be worn in addition to staying at least 6 feet apart, especially around people who don't live with youIf someone in your household is infected, people in the household should take precautions including wearing masks to avoid spread to others.

2-Wash your hands or use hand sanitizer before putting on your mask.

3-Wear your mask over your nose and mouth and secure it under your chin.
Fit the mask snugly against the sides of your face, slipping the loops over your ears or tying the strings behind your head.
If you have to continually adjust your mask, it doesn't fit properly, and you might need to find a different mask type or brand.

4-Make sure you can breathe easily.
Masks are required on planes, buses, trains, and other forms of public transportation traveling into, within, or out of the United States and in U.S. transportation hubs such as airports and stations. Travelers are not required to wear a mask in outdoor areas of a conveyance (like on a ferry or the top deck of a bus). CDC recommends that travelers who are not fully vaccinated continue to wear a mask and maintain physical distance when traveling
5-Stay 6 feet away from others
Inside your home: Avoid close contact with people who are sick.
If possible, maintain 6 feet between the person who is sick and other household members.
Outside your home: Put 6 feet of distance between yourself and people who don't live in your household. Remember that some people without symptoms may be able to spread virus.
Stay at least 6 feet (about 2 arm lengths) from other people.
6-Keeping distance from others is especially important for people who are at higher risk of getting very sick.
Get Vaccinated Authorized COVID-19 vaccines can help protect you from COVID-19.
You should get a COVID-19 vaccine when it is available to you Once you are fully vaccinated, you may be able to start doing some things that you had stopped doing because of the pandemic. Avoid crowds and poorly ventilated spaces .

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