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Cross-sectional Study

A cross-sectional study of gastrointestinal manifestations in COVID-19 Egyptian patients

Ahmed Abozaid Ahmed Teima [a,1], Amany Abas Amer [a,1], Lamiaa I. Mohammed [b], Zeinab A. Kasemy [c], Samar HA. Aloshari [d], Mohamed Meligy Ahmed [e], Ahmed Abuamer [e], Ahmed Shaban [e], Hassan Ahmed Elzohry [e], Sayed F. Abdelwahab [f], Heba Mohamed Abdallah [g], Sabry Moawad Abdelmageed [h], Mohamed A. Sakr [i], Mohamed Abdel-Samiee [e,*]

[a] Department of Tropical Medicine, Faculty of Medicine, Menoufia University, Shebin El-Kom, Egypt
[b] Shebin El-Kom Chest Hospital, Shebin El-Kom, Egypt
[c] Department of Public Health and Community Medicine, Faculty of Medicine, Menoufia University, Shebin El-Kom, Egypt
[d] Department of Public Health and Community Medicine, Faculty of Medicine, Taiz University, Yemen
[e] Department of Hepatology and Gastroenterology, National Liver Institute, Menoufia University, Shebin El-Kom, Egypt
[f] Department of Pharmaceutics and Industrial Pharmacy, Taif College of Pharmacy, Taif University, PO Box11099, Taif, 21944, Saudi Arabia
[g] Department of Clinical Pathology, National Liver Institute, Menoufia University, Shebin El-Kom, Egypt
[h] Department of Clinical Biochemistry and Molecular Diagnostics, National Liver Institute, Menoufia University, Shebin El-Kom, Egypt
[i] Medical Microbiology and Immunology Department, Faculty of Medicine, Suez University, Suez, Egypt

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ABSTRACT

Background: The latest novel corona virus disease (COVID-19) pandemic shows a significant health concern. We aimed to study the prevalence of gastrointestinal symptoms among COVID-19 Egyptian patients.
Methods: A cross-sectional study was carried out on 860 patients with COVID-19 infection classified according to Ministry of Health Program (MOHP) into three groups (280 patients with mild infection, 258 patients with moderate disease and 322 patients with severe disease). All patients were subjected to medical history, clinical examination, laboratory investigations, high-resolution computed tomography chest (HRCT chest) and other investigations when needed in some patients e.g., upper gastro-intestinal (GI) endoscopy, abdomino-pelvic ultrasound and ECHO.
Results: Gastro-intestinal symptoms were present in 27.2% of the studied patients. The most common reported GIT symptoms were vomiting, diarrhea, abdominal/gastric pain, followed by nausea. GIT symptoms presence was significantly higher in severe cases in comparison to mild or moderate cases. C-reactive protein (CRP), serum ferritin, Aspartate aminotransferase (AST), bilirubin, and creatinine were significantly associated with the presence of GI symptoms.
Conclusions: GI symptoms are prevalent among COVID-19 patients, the most common were vomiting and diarrhea and were associated with COVID-19 severity.

1. Introduction

Newly emerging Corona viruses have been designated extreme SARS-CoV-2 by the International Committee on Virus Taxonomy's Corona virus Study Group [1]. A severe pandemic with incubation periods of 6.4 days (mean average), from 2.1 to 11.1 days, was caused by the SARS-CoV-2 disease (COVID- 19) [2]. The primary route of transmission of COVID-19 is by aerosolized droplets that can be transmitted fecally orally [3]. SARS-CoV-2 has been shown to last for up to nine days on inanimate surfaces. It can also be infective with an infected

Abbreviations: COVID-19, Corona virus disease; MOHP, Ministry of Health Program; GI, Gastrointestinal; HRCT chest, high-resolution computed tomography chest; CRP, C-reactive protein; AST, Aspartate aminotransferase; ACE2, angiotensin convertory enzyme 2; PCR, Polymearase chain reaction; ALT, alanine aminotransferase; CO-RAD, COVID-19 Reporting and Data System; TNF, tumor necrosis factor; IL, interleukin; LDH, Lactate Dehydrogenase.

* Corresponding author.
E-mail address: Drmohammed100@yahoo.com (M. Abdel-Samiee).
[1] Ahmed Abozaid Ahmed Teima and Amany Abas Amer are first authors.

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individual without near contact [4].

The asymptomatic individual can transmit COVID-19 infections and can be detected even after the negative viral RNA in stools. Before signing the index case, more than 40% of COVID-19 infections can be transmitted [5].

A wide range of clinical events and x-rays make the identifying of COVID-19 and other more common respiratory infections hard for clinicians. The usual symptoms are fever, cough, breathing difficulties, and myalgia and tiredness. However, sudden anosmia and a loss of taste were also recorded atypically isolated [6].

Interestingly, the gastrointestinal (GI) presentation of diarrhea, vomiting and abdominal pain also occurred in COVID-19 patients [7]. Studies have shown that GI epithelial cells are expressed in the COVID-19 receptor, i.e., an angiotensin convertor enzyme 2 (ACE2) [8]. These data also indicate the ability of COVID-19 to be proactive and can increase significantly in the GI tract.

ACE2, which has been shown to be the receptor for various corona viruses such as SARS-COV, explained the mechanisms of participation in the gastrointestinal tract. COVID-19 has also been shown to use ACE2 for the entry phase as a viral receptor [9]. ACE2 is considered to be wealthy in human lung epithelial cells and GI tracts that may promote confirmation of the potential route to infection by COVID-19. This is highly expressed in gastric, duodenal and rectal cells, which promote the introduction of COVID-19 into the host cells [10].

The Cohort Study showed that the expression of ACE2 in cholangiocytes (59.7% of cells in cholangiocytes) was considerably increased relative to the liver cells (2.6% of cells). However, there was not any viral involvement in liver specimens in the histopathological sample of COVID-19 patients. In COVID-19 patients with medicines used in treatments or systemic inflammatory response caused by pneumonia, there may be other possibilities for liver abnormality [11].

In a recent study analyzing COVID-19 patients, the length of positive stool varying from one to 12 days was found to be positive in 53.4% of the patients for COVID-19 [12]. Interestingly, even after an adverse polymearase chain reaction (PCR) examination in their respiratory specimen, 23.3% of the patients were persistently positive for COVID-19 infection in stool. Eight children persistently tested positively in rectal swabs even after neopharyngeal clearance of the virus in another study, which followed 10 pediatric patients and analyzed their rectal and rectal swabs [13]. There was also evidence of fecal-oral transmission in COVID-19 infection in another study, Zhang et al., identified the presence of viral RNA in the anal swab and fecal specimens of COVID 19 patients. Rectal swab may therefore also be instrumental in determining viral clearance [7].

Patients with GI symptoms generally have more time than patients without GI from onset of symptoms to hospital admission (9.0 days vs. 7.3 days, respectively) [14]. GI symptoms, including diarrhea (2%–10.1%), nausea and vomiting (1%–3.6%) were not very frequent in one initial retrospective study from Wuhan [15]. However, up to 48.5% (204 patients) in evolving COVID-19 studies have registered GI symptoms in China. Symptoms including anorexia, diarrhea, vomiting and stomach pain also occurred [16].

In chronic liver diseases such as viral hepatitis B or C, COVID-19 infection can manifest as a serious infection (globally health burden particularly in Egypt) [17–21]. In patients with chronic liver disease, little is known about the effects of COVID-19 infection [22–25]. If hepatic encephalopathy is present, patients with chronic liver disease should be evaluated for COVID-19, as should patients with hepatic hydrothorax, portopulmonary hypertension, or hepatopulmonary syndrome [26,27]. Non-urgent endoscopic procedures that are deemed aerosol-generating should be rescheduled, according to various GI societies [28]. Both elective procedures, such as screening and surveillance upper GI endoscopy and colonoscopy in asymptomatic patients, should be postponed, while urgent cases, such as GI bleeding, should be treated immediately [29].

This study examined the prevalence of GI symptoms among COVID-19 Egyptian patients, which was present approximately a quarter of the patients.

2. Methods

Eight hundred and sixty patients were enrolled in a cross-sectional study in the period from May 2020 to February 2021 and were classified in to three groups according to the severity of symptoms into three groups: Mild symptoms (n = 280), moderate symptoms (n = 258) and severe symptoms (n = 322). The classification of the severity of symptoms was done according to Egyptian Ministry of Health and Population Program (MOHP) "Diagnosis and Treatment Protocol for COVID-19". The present research was carried out in compliance with the recommendations for Good Clinical Practice. **A written informed consent was given by every participant prior to the initiation of study in routine clinical practice at three specialized treatment centers especially concerned with COVID-19 management (Menoufia University Hospitals, Shebin El-Kom Chest Hospital and National Liver Institute Hospital).** The study methodology was reviewed and found to be compliant with the 1975 Declaration of Helsinki's ethical principles, as evidenced by prior approval by the institution's human research committee (Institutional Review Board of Faculty of Medicine, Menoufia University, Egypt).

For all patients, complete history taking and clinical evaluation were done (general, chest, and abdominal examinations). The laboratory research included (A complete blood count using Sysmex XT 1800i (Sysmex Corporation, Kobe, Japan) with Fluorescent flowcytometry and hydrodynamic focusing principles, aspartate aminotransferase (AST), alanine aminotransferase (ALT), serum bilirubin, serum creatinine, CRP, lactate dehydrogenase (LDH), and D-dimer by using a photometric unit of the auto-analyzer the Cobas 6000 analyzer (c501 module), serum ferritin using Cobas 6000 (e 601 module), arterial blood gases were done. Nasopharyngeal and oropharyngeal swabs were collected for COVID-19 (PCR) test by using Rotor Gene real-time PCR with fluorescence system (QIAGEN, GmbH, Germany). **The research was registered in the Academic Research Registry Department, number 2/2021TROP4. The work has been reported in line with the Strengthening the Reporting of Cohort Studies in Surgery (STROCSS) criteria.** [30].

2.1. Statistical analysis

SPSS Version 22.0 was used for statistical analysis (SPSS Inc., Chicago, IL, USA). The mean or no SD and percentage of patient demographic data were expressed. For qualitative variables it was calculated with Pearson's chi-square ($\chi 2$) test the importance of the relation of both groups. The exact test of Fisher was used when less than five were one of the predicted cells. For parametric data, more than two groups used the ANOVA (F) test, and Kruskal-Wallis test for non-parametric data. Tests were conducted for homogeneity of variance and post-hoc test Tukey was used for presumed equivalence, while test Dennett T3 had been used for assumed unequal variance. A p-value was considered significant if < 0.05.

3. Results

This study assessed 860 patients with COVID-19 infection. The mean age of studied patients was 46.1 ± 11.8 and ranged from 17 to 81 years old, 45.8% of the studied patients were males and 54.2% was females. The most common symptoms were cough (33%), dyspnea (21.9%) and fever (20%). The most common GIT symptoms were vomiting (40.1%), diarrhea (37.6%) then abdominal and gastric pain (29.1%) (Table 1).

COVID-19 severity was distributed as 32.6% mild, 30% moderate and 37.4% severe. GIT symptoms present in 27.2% of studied patients (Fig. 1).

Age significantly differed as regard COVID-19 severity where old age

Table 1
Clinical data of studied patients (no = 860).

	No	%
Age		
Mean ± SD	46.1 ± 11.8	
Range	17–81	
Gender		
Male	394	45.8
Female	466	54.2
Symptoms		
Fever	176	20.5
Cough	284	33.0
Dyspnea	188	21.9
Fatigue/bone ache	110	12.8
Sore throat	66	7.7
Headache	56	6.5
Chest pain	8	0.9
Disturbed conscious level	16	1.9
Anosmia	80	9.3
GIT symptoms (no=117)		
Nausea	10	4.2
Vomiting	94	40.1
Diarrhea	88	37.6
Aguesia	38	16.2
Abdominal/Epigastric pain	68	29.1
Anorexia	8	3.4
Melena	16	6.8
Hematemesis	8	3.4

SD= Standard Deviation, GIT= Gastrointestinal tract, No= Number.

patients had a severe disease. As regard presentation symptoms, cough, dyspnea, fatigue/bone ache and chest pain were significantly higher in severe cases while fever and anosmia were significantly higher in mild and moderate cases. Presence of GIT symptoms was significantly higher in severe cases (34.2%) in comparison to 21.4% in mild COVID-19 patients and moderate cases (24.8%). Diarrhea and melena were significantly high in severe COVID-19 patients (Table 2).

Severe COVID-19 patients showed significantly higher laboratory investigations and lower Oxygen saturation in comparison to mild and moderate COVID-19 patients ($P < 0.001$) (Table 3).

Regarding GIT symptoms presence and clinical data of studied patients, there was no significant difference in age, and gender. However, there was a significant difference in COVID-19 Reporting and Data System (CO-RAD) grading (36.8% with GIT symptoms had grade V CO-RAD) (Table 4).

CRP, D-Dimer, LDH, serum ferritin, ALT, AST, and creatinine were significantly higher in patients with GIT symptoms than patients without GI symptoms. Oxygen was significantly lower in patients with GI symptoms ($P < 0.05$) (Table 5).

4. Discussion

SARS-CoV-2, a highly transmissible, novel respiratory pathogen infecting humans, caused the latest COVID-19 pandemic, which began in December 2019 [31]. Fever, dry cough, loss of taste or scent, weakness, shortness of breath, and acute respiratory manifestations are all common COVID-19 symptoms [32]. GI signs, according to the Centers for Disease Control and Prevention in the United States, may be a sign of COVID-19 infection. In addition, viral shedding in the stool of infected patients is not unusual. GI manifestations of COVID-19 infection including diarrhea, nausea, vomiting, and abdominal discomfort were commonly reported by some cohort studies which determined the prevalence of GI symptoms at presentation of COVID-19 and viral shedding in stool of patients with confirmed SARS-CoV-2 infection [33].

In this study, the most reported symptom was cough (33%) followed by shortness of breath (21.9%) and fever (20.5%). These data are in agreement with those obtained by *Matthew* et al. [34], in USA and *Guan* et al. [35], in mainland China. However, these results were different from Wang et al. [36], in Wuhan-China, Fever (43.8% on admission and 88.7% during hospitalization) was the most common symptom, accompanied by cough (67.8%). This difference could be attributed to the nature of COVID-19 infection which can cause varying degrees of illness and symptoms. This study showed that anosmia was reported in 9.3% of patients. These data are consistent with those of *Andrea* et al. [37], who found that33.9% of patients reported olfactory disorders and suggested that SARS-CoV2 has a *trans*-neural penetration through the olfactory bulb [38]. Furthermore, the ACE2 receptor, which SARS-CoV-2 uses to bind and penetrate into cells, is commonly expressed on olfactory mucosa and oral cavity epithelial cells [39].

This study revealed that, GIT symptoms were present in 27.2% of patients. The most common reported GIT symptoms were vomiting (40.1%), diarrhea (37.6%), abdominal/gastric pain (29.1%) followed by nausea (4.2%). These findings were supported by *Tianet al.* [40], and *Fang* et al. [41], in China. The existence of ACE2 and virus nucleocapsid protein, which were found in GI epithelial cells and infectious virus particles isolated from the patients' stool, could explain the high incidence of GIT symptoms [40].

CRP, serum ferritin, AST, bilirubin, and creatinine levels were all significantly higher in COVID-19 patients with GI symptoms compared to those without. These findings were backed up by evidence from *Ghoshalet al.* [42], who found that patients with GI symptoms were more likely to have serious, critical illness, irregular laboratory findings, and a fatal outcome than those who did not have GI symptoms.

The findings of this study revealed that the COVID-19 severity of symptoms was mild (32.6%), with patients having some of the signs and symptoms of COVID-19 (e.g., fever, cough, sore throat, malaise,

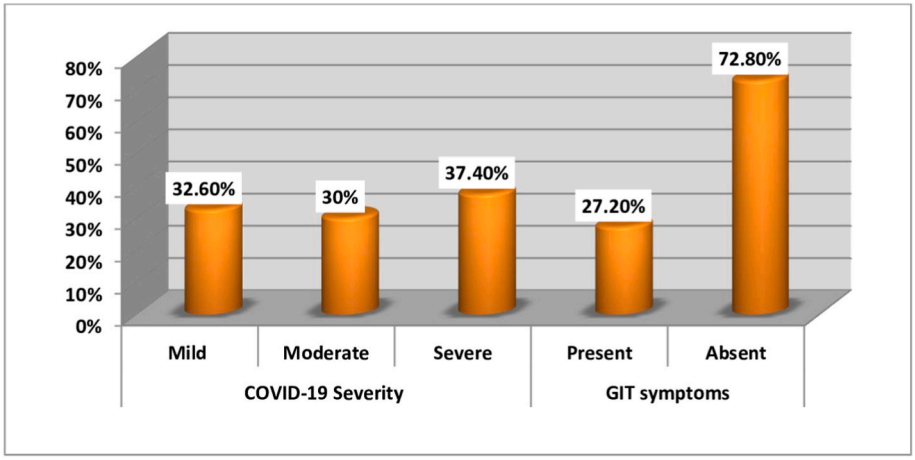

Fig. 1. Distribution of the studied participants regarding COVID-19 severity and GIT symptoms.

Table 2
Relation between disease severity and clinical finding of studied patients.

	Mild No = 280		Moderate No = 258		Severe No = 322		Test of sig	p value
	no	%	no	%	no	%		
Age (Years)								
Mean ± SD	40.02 ± 11.3		44.25 ± 11.20		53.03 ± 8.87		F = 122	P1,2,3 < 0.01*
Gender								
Male	128	45.7	114	44.2	152	47.2	χ^2	
Female	152	54.3	141	55.8	170	52.8	0.528	0.768
Symptoms							χ^2	
Fever	80	28.5	40	15.5	56	17.3	17.07	<0.001*
Cough	92	32.8	102	39.5	90	27.9	8.70	0.012*
Dyspnea	0	0	36	13.9	152	47.2	208.8	<0.001*
Fatigue/bone ache	60	21.4	22	8.5	28	8.6	40.01	<0.001*
Sore throat	22	7.8	44	17.1	0	0	58.8	<0.001*
Headache	26	11.1	20	7.7	10	3.1	10.3	0.005*
Chest pain	0	0	0	0	8	2.4	13.49#	0.001*
Disturbed conscious level	0	0	4	1.5	12	3.7	11.59#	0.003*
Anosmia	20	7.4	22	8.5	2	0.6	21.9	<0.001*
GIT symptoms							χ^2	
Present	60	21.4	64	24.8	110	34.2	13.33	0.001*
Absent	220	78.6	194	78.2	212	65.8		
GIT symptoms							χ^2	
Nausea	10	3.5	0	0	0	0	20.9#	<0.001*
Vomiting	28	10	26	10.1	40	12.4	1.18	0.554
Diarrhea	6	2.1	32	12.5	50	15.5	31.10	0.002*
Aguesia	12	4.2	6	2.3	20	6.2	5.14	0.076
Abdominal/Epigastric pain	14	5	18	6.9	36	11.1	7.70	0.021*
Anorexia	4	1.4	2	0.7	2	0.6	1.16#	0.561
Melena	0	0	4	1.5	12	3.7	11.59#	0.003#
Hematemesis	0	0	4	1.5	4	1.2	4.05#	0.132

F = one way ANOVA test χ^2 = chi-square test #Fischer's exact test *:significant.
SD= Standard Deviation, **GIT** = Gastrointestinal tract, **No**= Number.

headache, muscle pain, nausea, vomiting, diarrhea, loss of taste and smell) but no shortness of breath, dyspnea, or other respiratory symptoms. Patients with signs of lower respiratory disease during clinical evaluation or imaging and a concentration of oxygen (SpO2) of less than 94% on room air made up 30% of the mild cases. Patients with serious illness with (SpO2) 94% on room air, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO2/FiO2) 300 mm Hg, respiratory frequency >30 breaths/min, or lung infiltrates >50% were also found in 37.4% of the cases.

In this study, we noticed that age significantly differed as regarding COVID-19 severity where old age patients (53.03 ± 8.87) had severer disease symptoms. This result agreed with those obtained by *Khan* et al. [43], and *Shahid* et al. [44] This finding could explain the likelihood of old patients having multiple co-morbidities and even greater risk of increased infection severity and mortality from SARS-CoV-2 [44].

In this study, dyspnea, cough, fatigue/bone ache and chest pain were significantly higher in severe cases. Most patients with severe COVID-19 illness present with typical symptoms such as shortness of breath, cough (with or without sputum), muscle ache, arthralgia, exhaustion, fatigue, chest tightness, and dyspnea, according to *Lei* et al. [45].

In this study, GI symptoms presence was significantly higher in severe cases (34.2%) in comparison to in mild (21.4%) and in moderate (24.8%) COVID-19 cases. Diarrhea was significantly higher in severe COVID-19 patients. This result is strongly supported a study from China [46].

The results of this study revealed a significantly higher laboratory investigations (CRP, D-dimer, serum ferritin, LDH, AST, ALT, serum creatinine and serum bilirubin level) in severe COVID-19 patients. These findings matched those of one study [46], in which extreme COVID-19 cases showed signs of systemic inflammatory reactions, including hyperferritinemia, which is triggered by excessive inflammation and the release of inflammatory cytokines such as tumor necrosis factor (TNF), interleukin (IL)-6, IL-12, and IL-8 in the immunopathogenic pathway of COVID-19. Hyperferritinemia is linked to admission to the intensive care unit and a high mortality rate, and it can be used to identify high-risk patients and direct clinical action to reduce inflammation.CRP and D-dimer were also discovered to be two additional independent risk factors for disease severity in one study [47], and serum ferritin levels were found to be positively correlated with CRP levels.

According to a recent study, COVID-19 cases were classified into two categories (severe and mild) based on the need for mechanical ventilation, and reported that, hyperlipidemia in severe group was 36.4% vs. 0% in mild group [48]. Also, elevated LDH, transaminases and CRP were observed in the severe group. Also, the authors stated that individuals with COVID-19 may have a number of complex and varied coagulation abnormalities in the direction of an underlying hypercoagulable state and this explain elevated D-dimer levels; particularly in the severe group [48].

In our study, there was lower oxygen saturation in severe COVID-19 patients (84.1 ± 4.8) in comparison to mild (97.1 ± 1.41) and moderate cases (95.3 ± 1.41).These results agree with another report, where patients with severe COVID-19were described as exhibiting lower oxygen levels with silent hypoxemia in some cases [49]. This was explained by the possibility that corona virus has an idiosyncratic action on receptors involved in chemo-sensitivity to oxygen. Also, diffuse systemic endothelitis and micro-thrombi which play an important pathogenic role in exacerbation of hypoxic pulmonary vasoconstriction. Also, oxygen saturation was significantly lower in patients with GIT symptoms (90.5 ± 7.2) than those without symptoms (92.1 ± 6.4).

In this study, there was no significant difference for age or gender regarding GIT symptoms presence. This result agrees with one report examining the influence of age, gender, racial and co-morbidities existence on COVID-19 where they found that these factors (male gender, age and other chronic co-morbid illnesses)are associated with increased morbidity, severity risk and decreased rate of COVID-19 patients' survival but with no significant relationship with clinical presentation at admission [50].

There was no significant difference in CO-RAD grading in the studied

Table 3
Distribution of laboratory findings regarding severity of COVID-19 infection.

	Mild No = 280	Moderate No = 258	Severe No = 322	p value
	Mean ± SD	Mean ± SD	Mean ± SD	
Lymphocytes ($\times 10^9$/L)	0.75 ± 1.3	0.48 ± 0.59	2.18 ± 2.5	P1,2 <0.001* P3 = 0.712
Range	0.1–3.8	0.1–6.0	0.1–8.0	
Median	1.98	2.18	2.56	
CRP (mg/l)	11.3 ± 3.4	24.5 ± 10.4	41.1 ± 16.2	P1,2,3
Range	6–20	8–64	10–96	<0.001*
Median	11	24	36	
D- Dimer (mg/l)	0.24 ± 0.13	0.82 ± 0.33	1.70 ± 0.55	P1,2,3 <0.001*
Range	0.01–0.5	0.4–2.10	0.90–3.50	
Median	0.30	0.70	1.60	
Serum ferritin (ng/ml)	121.4 ± 21.9	276.5 ± 39.1	292.9 ± 96.3	P1,2<0.001* P3 = 0.004*
Range	57–150	140–363	160–486	
Median	123	278	306.5	
LDH (U/L)	184.1 ± 35.1	299.1 ± 18.6	363.4 ± 54.6	P1,2,3<0.001*
Range	100–270	258–368	236–490	
Median	184	293	360	
AST (U/L)	25.7 ± 5.6	29.7 ± 8.1	40.7 ± 49.6	P1 = 0.134
Range	12–39	13–68	18–542	P2 = <0.001*
Median	25	29	32	P3 = <0.001*
ALT (U/L)	28.7 ± 6.9	33.6 ± 27.4	48.1 ± 88.4	P1 = 0.316
Range	1–52	18–323	13–980	P2 = <0.001*
Median	28	31	34	P3 = 0.002
Direct billirubin (mg/dl)	0.90 ± 0.21	0.92 ± 0.28	1.09 ± 0.89	P1 = 0.679
Range	0.3–1.4	0.5–3	0.5–9.5	P2 = <0.001*
Median	1.00	0.90	1.00	P3 = 0.001*
Creatinine (mg/dl)	0.91 ± 0.21	0.93 ± 0.24	0.99 ± 0.32	P1 = 0.456
Range	0.30–1.50	0.40–1.6	0.30–2	P2 = 0.001*
Median	0.90	1.00	1.00	P3 = 0.009*
Oxygen saturation (%)	97.1 ± 1.41	95.3 ± 1.41	84.1 ± 4.8	P1,2,3 <0.001*
Range	94–100	92–89	70–95	
Median	97	95	85	

P1 = Mild vs Moderate P2 = Mild vs severe P3=Moderate vs. severe.
SD= Standard Deviation, **GIT** = Gastrointestinal tract, **No**= Number; **AST** = Aspartate aminotransferase, **ALT** = Alanine aminotransferase, **CRP**= C reactive protein, **LDH** = Lactate Dehydrogenase.

Table 4
Distribution of clinical data finding regarding presence of GIT symptoms among the studied patients.

	GIT symptoms				p value
	Absent No = 626		Presence No = 234		
	no	%	no	%	
Age (Years)					
Mean ± SD	46.7 ± 12.43		45.9 ± 11.61		0.393
Gender					
Male	278	44.4	116	49.6	0.176
Female	348	55.6	118	50.4	
CO-RAD					
I	220	35.4	60	25.6	0.008*
II	90	14.4	42	17.9	
III	80	12.7	20	8.5	
IV	64	10.2	26	11.1	
V	172	27.4	86	36.8	

SD= Standard Deviation, CO-RAD= COVID-19 Reporting and Data System, GIT= Gastrointestinal Tract, No= Number.

Table 5
Distribution of laboratory investigations finding regarding presence of GIT symptoms among the studied patients.

	GIT symptoms		p value
	Absent No = 626	Presence No = 234	
	Mean ± SD	Mean ± SD	
Lymphocytes ($\times 10^9$/L)	2.2 ± 4.5	2.6 ± 4.7	0.111
Range	0.1–6.0	0.4–7.0	
Median	2.58	2.74	
CRP (mg/l)	24.6 ± 15.3	31.4 ± 20.2	<0.001*
Range	6–80	6–96	
Median	22	25	
D- Dimer (mg/l)	0.92 ± 0.73	1.07 ± 0.75	0.013*
Range	0.01–3.50	0.04–3.10	
Median	0.70	1.00	
Serum ferritin (ng/ml)	222.8 ± 99.5	250.7 ± 104.8	0.001*
Range	57–486	95–460	
Median	199	268	
LDH (U/L)	281.2 ± 86.1	296.6 ± 87.9	0.025*
Range	113–480	100–490	
Median	290	299	
AST (U/L)	29.2 ± 8.1	41.4 ± 58.1	0.002*
Range	13–71	12–542	
Median	29	30	
ALT (U/L)	32.1 ± 18.2	51.6 ± 103.5	0.004
Range	1–323	19–980	
Median	31	31	
Direct billirubin (mg/dl)	0.93 ± 0.27	1.14 ± 1.06	0.243
Range	0.3–1.8	0.5–9.5	
Median	1.00	1.00	
Creatinine (mg/dl)	0.93 ± 0.27	1.01 ± 0.29	<0.001*
Range	0.30–2	0.5–2	
Median	0.90	1.00	
Oxygen saturation(%)	92.1 ± 6.4	90.5 ± 7.2	0.002*
Range	74–100	70–100	
Median	95	93	

*: significant.
SD= Standard Deviation, **GIT** = Gastrointestinal tract, **No**= Number; **AST** = Aspartate aminotransferase, **ALT** = Alanine aminotransferase, **CRP**= C reactive protein, **LDH** = Lactate Dehydrogenase.

patients regarding GIT symptoms presence. A recent report showed that CO-RAD is a categorical taxonomic evaluation scheme for standardized assessment of COVID-19 pulmonary involvement and with CO-RAD interpretation with the duration and type of symptoms, as well as other clinical and laboratory findings. There was a weak correlation to clinical symptoms. It mainly comes to building a diagnosis of COVID-19 lung involvement before RT-PCR tests are available [51].

5. Conclusion

GI symptoms are prevalent among COVID-19 Egyptian patients (27.2%), and the most common GI symptoms were vomiting and diarrhea. Interestingly, GI symptoms were associated with COVID-19 severity.

Ethics approval and consent to participate

All study participants were given the opportunity to give their informed consent in writing. The ethical committee reviewed and accepted the report {Institutional Review Board, Faculty of Medicine, Menoufia University}.

Consent for publication

The manuscript's content has been approved by all authors.

Availability of data and material

All data are available upon request from the first author: Dr Ahmed Abozaid Ahmed Teima.

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Authors' contributions

All authors contributed to the conceptualization (AT), design (LM), data curation (HA; SA), resource identification (MA; HE), formal analysis (ZK; SA), and data interpretation (MS; S F. A). Validation and technique (AA; MA), as well as revision of new software used in the work. All authors shared writing of this work.

Provenance and peer review

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Declaration of competing interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.103234.

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