Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Clinical Nutrition ESPEN 41 (2021) 423–428

Contents lists available at ScienceDirect

Clinical Nutrition ESPEN

journal homepage: http://www.clinicalnutritionespen.com

Original article

Nutritional status assessment in patients with Covid-19 after discharge from the intensive care unit

Nassim Essabah Haraj [a, m], Siham El Aziz [a, m], Asma Chadli [a, m, *], Asma Dafir [b, m], Amal Mjabber [a, m], Ouissal Aissaoui [b, m], Lhoucine Barrou [b, m], Chafik El Kettani El Hamidi [b, m], Afak Nsiri [c, m], Rachid AL Harrar [c, m], Hanane Ezzouine [d, m], Boubaker Charra [d, m], Maha Soussi Abdallaoui [e, m], Nisrine El Kebbaj [f, m], Nabiha Kamal [g, m], Ghali Mohamed Bennouna [h, m], Kamal Marhoum El Filali [i, m], Benyounes Ramdani [j, m], Naima El Mdaghri [k, m], Mohamed Benghanem Gharbi [j, m], Moulay Hicham Afif [l, m]

[a] Department of Endocrinology and Metabolic Diseases, CHU Ibn Rochd, Casablanca, Morocco
[b] Surgical Intensive Care and Anaesthesia Department, CHU Ibn Rochd, Casablanca, Morocco
[c] Surgical Emergencies Intensive Care and Anaesthesia Department, CHU Ibn Rochd, Casablanca, Morocco
[d] Medical Intensive Care Department, CHU Ibn Rochd, Casablanca, Morocco
[e] Laboratory of Parasitology, CHU Ibn Rochd, Casablanca, Morocco
[f] Department of Psychiatry, CHU Ibn Rochd, Casablanca, Morocco
[g] Laboratory of Biochemistry, CHU Ibn Rochd, Casablanca, Morocco
[h] Cardiology Department, CHU Ibn Rochd, Casablanca, Morocco
[i] Department of Infectious Diseases, CHU Ibn Rochd, Casablanca, Morocco
[j] Department of Nephrology, CHU Ibn Rochd, Casablanca, Morocco
[k] Microbiology Laboratory, CHU Ibn Rochd, Casablanca, Morocco
[l] Pneumology Department, 20 Août Hospital, CHU Ibn Rochd, Casablanca, Morocco
[m] Faculty of Medicine and Pharmacy, University Hassan II, Casablanca, Morocco

ARTICLE INFO

Article history:
Received 29 July 2020
Accepted 29 September 2020

Keywords:
Nutritional status
COVID-19
Rehabilitation
Intensive care units

SUMMARY

Introduction: The nutritional diagnosis and early nutritional management of COVID-19 patients must be integrated into the overall therapeutic strategy.
The aim of our study is to assess the nutritional status of patients with COVID-19 after a stay in intensive care, to describe the prevalence of undernutrition, to determine the factors influencing undernutrition and to describe the nutritional management.
Tools and methods: This is a descriptive observational study of adult patients admitted to the endocrinology service for additional care after a stay in intensive care during the period from April 17, 2020 to May 26, 2020. The assessment tool used was the Mini Nutritional Assessment (MNA).
Results: Our study included 41 patients; the average age of the patients was 55 years, 51.2% had a severe or critical form of COVID-19, 75.6% stayed in intensive care, 12.2% had a loss of autonomy. The average BMI was 25.2 kg/m^2 (17–42 kg/m^2), 42.5% were overweight, 61% had weight loss, 26.2% had weight loss greater than 10%, 14.6% of our patients were undernourished, 65.9% were at risk of undernutrition, 19.5% had hypoalbuminemia, 17.1% had hypoprotidemia, 19.5% hypocalcemia, 34.1% anemia, 12.2% hypomagnesemia and 51.2% had a deficiency in vitamin D. A positive correlation was found between poor nutritional status and a longer stay in intensive care (>5 days) ($p = 0.011$) and lymphopenia ($p = 0,02$).
Conclusion: Despite a personalized diet, 14.6% of patients presented undernutrition. Particular attention should be paid to patients with a long stay in intensive care.

* Corresponding author. Endocrinology and Diabetology Department, Ibn Rochd University Hospital of Casablanca, 20360, Casablanca, Morocco.
E-mail address: drachadli@gmail.com (A. Chadli).

https://doi.org/10.1016/j.clnesp.2020.09.214
2405-4577/

1. Introduction

The university hospital centers are a tertiary care structures which takes care of the serious and critical cases of COVID-19, which are at great risk of undernutrition. The nutritional diagnosis and early nutritional management of COVID-19 patients must be integrated into the overall therapeutic strategy, as with any acute case of metabolic attack [1,2]. Several tools have been proposed for the evaluation of the nutritional status [3,4]. The Mini Nutritional Assessment (MNA), recommended for the evaluation of nutritional status in patients in healthcare settings [5–7], appears ideal for patients with COVID -19, alongside a clinical and paraclinical evaluation.

COVID-19 is a disease characterized by an inflammatory syndrome, leading to reduced food intake and increased muscle catabolism, therefore patients with COVID-19 are at high risk of malnutrition, which makes prevention of malnutrition and nutritional management key aspects of care.

Patients who recovered from COVID-19 after a stay in intensive care have lost weight and frequently present with respiratory, cardiovascular and neurological impairments. These deficiencies require prolonged treatment which affects their nutritional status, with a major risk of undernutrition [8–10].

A special organization was carried out in our university hospital center, so that all patients with COVID-19 after a stay in intensive care and after a negative PCR result are admitted to the endocrinology service to ensure additional medical care including nutritional care before discharge.

The objective of our study is to assess the nutritional status of patients followed for COVID-19, to describe the prevalence of undernutrition and to determine the factors influencing undernutrition and describe the nutritional management of these patients.

2. Patients and methods

This is an observational descriptive study on adult patients transferred from the intensive care unit to the endocrinology service following COVID-19 infection after negative PCR results during the period of April 17, 2020 to May 26, 2020. Non-consenting patients were excluded from the study.

Data collection was carried out using a questionnaire comprising the following sections:

Questions relating to the clinical characteristics of the patient (anthropo-demographic data, data related to diabetes, cardiovascular risk factors, other comorbidities).

Data related to COVID-19 infection: date of contamination, severity of the COVID-19 case, treatment received, length of hospital stay, intensive care stay with intubation, date of negative PCR result.

A section containing the MNA questionnaire: 3 groups were selected at the end of the data collection: Group 1 of subjects with normal nutritional status (overall MNA score between 24 and 30), Group 2 of subjects at risk of undernutrition (having an overall MNA score between 17 and 23.5), Group 3 of malnourished subjects (overall MNA score less than 17) [5].

The study parameters and measures were taken on site following a clinical examination (weight, BMI, blood pressure, capillary glycemia).

Patient autonomy was assessed using Katz autonomy scale for basic Activities of Daily Life (ADL) score [11], and quality of life by Hamilton anxiety and depression scores, Hospital Anxiety and Depression Scale (HADS) and the Post-Traumatic Checklist Scale (PCLS) for post-traumatic stress assessment [12–15].

For the biological evaluation, all patients benefited from a complete nutritional assessment (blood count, lipid assessment, glycemia, albumin, protein, measurement of trace elements, calcemia, vitamin D).

All the patients in the study received a nutritional and educational program adapted to their nutritional status.

The statistical analysis was done by IBM SPSS Statistics 20 software using the Chi-square test to obtain the p value. A value of $p < 0.05$ is considered to be statistically significant.

Free and informed consent was taken before inclusion in the study, while respecting the anonymity of patients when collecting data, with the approval of the ethics committee.

3. Results

3.1. Demographic and clinical characteristics of patients (Table 1)

The study included 41 patients with an average age of 55 years (19–85 years), and a sex ratio of 1.05, 24.4% were over 70 years of age. 43.9% diabetic, and 34.1% hypertensive and 4.9% asthmatic. The mode of contamination was unknown in 46.3% of cases.

All patients were treated with the Hydroxychloroquine, Azithromycin, zinc, vitamin C and Corticoids protocol. Negative PCR results were obtained on average after 16.73 days of hospitalization (9–35 days), 21.95% presented complications during hospitalization, two patients presented a pulmonary embolism, two patients suffered an acute coronary syndrome requiring the placement of stents in one patient, toxidermia in two patients, hepatocellular insufficiency in one patient, peripartum cardiomyopathy in one patient, and deep bradycardia in one patient.

3.2. Nutritional assessment

From the MNA score, 14.6% of patients suffered from undernutrition and 65.9% had a risk of undernutrition. The average BMI was 25.2 kg/m^2, 61% of patients experienced weight loss which was greater than 10% in 24% of cases, 12.2% of patients were non-autonomous according to the ADL scores. Biologically, 19,5% had hypoalbuminemia, 17,1% had Hypoproteinemia, 19,5% hypocalcemia, 34,1% anemia, 12,2% hypomagnesemia and 51,2% had a deficiency in vitamin D (Table 2).

A positive correlation was found between poor nutritional status and the long stay in intensive care ($p = 0.011$) and lymphopenia ($p = 0,02$). (Table 3).

All patients benefited from personalized nutritional management with supplementation of vitamin D and trace element deficiencies.

4. Discussion

At the end of 2019, a new coronavirus called SARS-CoV-2 appeared in Wuhan, China. It was responsible for the emergence of a new acute respiratory infection now known as “COVID-19”. It was declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [16]. As of September 24, 2020, it had reached 30 675 675 people and caused 954 417 deaths [17].

In all countries facing the epidemic, the great challenge is the management of severe cases. Based on the risk factors linked to lethality and the development of severe forms, in particular advanced age and the presence of comorbidities. Morocco has a young population with only 7.4% who are over 65, while one in four Italians, for example, is over 65 [18]. But Morocco is experiencing an increase in the number of chronic diseases, 21% of the Moroccan population suffers from at least one chronic disease; with a

Table 1
Summarizes patient demographics and characteristics related to infection.

	Patient Characteristics
Age	55 ± 18.32
Age Range	
<45 years	(11) 26.8%
45–70 years	(20) 48.8%
>70 years	(10) 24.4%
Sex	
F	48.8%
M	51.2%
Antecedents	
Diabetes	(18) 43.9%
High blood pressure	(14) 34.1%
Asthma	(2) 4.9%
Employed	
Yes	(24) 58.5%
No	(17) 41.5%
Marital Status	
Single	(4) 9.8%
Married	(33) 80.5%
Divorced	(1) 2.4%
Widower	(3) 7.3%
Severity classification	
Mild case	(3) 7.3%
Moderate case	(17) 41.5%
Severe case	(16) 39%
Critical case	(5) 12.2%
Intensive Care Stay	
Yes	(31) 75.6%
No	(10) 24.4%
Intubation	
Yes	(5) 12.2%
No	(36) 87.8%
Negative PCR	
≤9 days	(16) 39%
Between 9 and 14 days	(8) 19.5%
Between 14 and 30 days	(15) 36.6%
>30 days	(2) 4.9%
C reactive protein CRP	
Normal	(15) 36,6%
High	(26) 63,4%
White blood cells	
Normal	(23) 56,1%
High	(18) 43,9%
Lymphopenia	
No	(30) 73,2%
Yes	(11) 26,8%
Hamilton anxiety	
Normal	(30) 73.2%
Mild to moderate anxiety	(6) 14.6%
Moderate to severe anxiety	(5) 12.2%
Hamilton depression	
Normal	(28) 68.3%
Mild depression	(7) 17.1%
Moderate depression	(3) 12.2%
Severe depression	(1) 2.4%
Hospital Anxiety and Depression Scale (HADS)	
Normal	(25) 61%
Borderline abnormal	(6) 14.6%
Abnormal	(10) 24.4%
Post-traumatic stress disorder	
Yes	(12) 29.3%
No	(29) 70.7%

Table 2
Summarizes the clinical and paraclinical nutritional characteristics of the patients.

	(Number of Patients) Percent
MNA SCORE	
Normal nutritional status	(8) 19,5%
At risk of undernutrition	(27) 65,9%
Proven undernutrition	(6)14,6%
ADL SCORE	
Autonomous	(36) 87,8%
Not autonomous	(5) 12,2%
Weight loss	
Yes	(25) 61%
No	(16) 39%
Weight loss	
≤5%	(7) 28%
Between 5% and 10%	(12) 48%
≥10%	(6) 24%
BMI	
BMI <18 kg/m^2	(3) 7,31%
BMI 18–25 kg/m^2	(18) 43,9%
BMI 25–30 kg/m^2	(17) 41,46%
BMI> 30 kg/m^2	(3) 7,31%
Biological	
Vitamin D	
Normal	(3) 7,3%
Insufficiency	(17) 41,5%
Deficiency	(21) 51,2%
Albumin	
Normal	(33) 80,5%
Low	(8) 19,5%
Proteins	
Normal	(34) 82,9%
Low	(7) 17,1%
Calcemia	
Normal	(33) 80,5%
Low	(8) 19,5%
Anemia	
No	(27) 65,9%
Yes	(14) 34,1%
Magnesium	
Normal	(36) 87,8%
Low	(5) 12,2%

prevalence of diabetes of 10.6%, high blood pressure of 29.3% and obesity of 20%. These diseases are also risk factors for lethality and the development of serious forms of COVID-19 requiring intensive care [19,20].

Patients cured of the infection, having lost weight and weakened after weeks in intensive care, frequently have more or less severe impairments, on the respiratory, cardiovascular, neurological, neurocognitive, or musculoskeletal level. These deficiencies require prolonged management which affects their nutritional status, with a major risk of undernutrition [8–10].

And in order to avoid the consequences of a severe form of COVID-19, our university hospital center, which is a tertiary care structure dedicated to the management of the most severe cases, has defined a course of care from the arrival of the patient in the emergency room, hospitalization in the intensive care unit, to their discharge from the Endocrinology service.

In our study, 14,2% of patients had a poor nutritional status and 65.9% a risk of undernutrition. The average BMI was 25.2 kg/m^2, 61% had weight loss, 24% had weight loss greater than 10%.

Recent studies and guidelines indicate that COVID-19 patients are at high risk of malnutrition. The most severe cases are encountered in particular in patients with a chronic disease, the elderly or those with co-morbidities. These diseases often mask the underlying protein malnutrition. Patients with COVID-19 should be considered at high risk for malnutrition. Li et al.'s study of elderly hospitalized patients with COVID-19 reported that 53% of patients suffered from malnutrition [21,22].

Undernutrition during COVID-19 infection can be explained by the increase in energy expenditure linked to ventilatory work during a severe respiratory infection which induces an inflammatory syndrome and hypercatabolism, and also by the very reduced food intake linked to several factors: anorexia secondary to infection, respiratory discomfort, anosmia, ageusia and digestive symptoms (diarrhea, vomiting or abdominal pain). Two Chinese

Table 3
Summarizes the results of the various correlations with the MNA score.

	MNA Score			p value
	Normal nutritional status (n = 8)	At risk of undernutrition (n = 27)	Proven undernutrition (n = 6)	
Sex				0.614
Man	4 (50%)	15 (55,55%)	2 (33,33%)	
Women	4 (50%)	12 (44,45%)	4 (66,67%)	
Age				0.794
<45 years old	3 (37,5%)	6 (22%)	2 (33,33%)	
45–70 years	4 (50%)	14 (52%)	2 (33,33%)	
>70 years	1 (12,5%)	7 (26%)	2 (33,33%)	
Marital status				0.343
Single	1 (12,5%)	1 (3,7%)	2 (33,33%)	
Married	7 (87,5%)	22 (81,5%)	4 (66,67%)	
Divorced	0 (0%)	1 (3,7%)	0 (0%)	
Widow	0 (0%)	3 (11,1%)	0 (0%)	
Diabetes				0.740
No	5 (62,5%)	14 (51,85%)	4 (66,67%)	
Yes	3 (37,5%)	13 (48,15%)	2 (33,33%)	
High Blood Pressure				0.975
No	5 (62,5%)	18 (66,67%)	4 (66,67%)	
Yes	3 (37,5%)	9 (33,33%)	2 (33,33%)	
Asthma				0.58
No	8 (100%)	25 (92,6%)	6 (100%)	
Yes	0 (0%)	2 (7,4%)	0 (0%)	
Complications during hospitalization				0,228
No	8 (100%)	20 (74%)	4 (66,67%)	
Yes	0 (0%)	7 (26%)	2 (33,33%)	
Negative PCR				0.964
≤9 days	3 (37.5%)	10 (37,03%)	3 (50%)	
Between 9 and 14 days	2 (25%)	5 (18,53%)	1 (16,67%)	
Between 14 and 30 days	3 (37.5%)	10 (37,03%)	2 (33,33%)	
>30 days	0 (0%)	2 (7,41%)	0 (0%)	
Severity classification				0.392
Mild case	1 (12,5%)	2 (7,41%)	0 (0%)	
Moderate case	5 (62,5%)	11 (40,74%)	1 (16,67%)	
Severe case	2 (25%)	11 (40,74%)	3 (50%)	
Critical case	0 (0%)	3 (11,11%)	2 (33,33%)	
Intensive care stay				0.089
No	4 (50%)	6 (22,22%)	0 (0%)	
Yes	4 (50%)	21 (77,78%)	6 (100%)	
Intensive care stay < 5 days				0.011
No	0 (0%)	14 (66,67%)	1 (16,67%)	
Yes	4 (100%)	7 (33,33%)	5 (83,33%)	
Intubation				0.498
No	8 (100%)	23 (85,18%)	5 (83,33%)	
Yes	0 (0%)	4 (14,82%)	1 (16,67%)	
Inflammation: C Reactive Protein CRP				0,234
Normal	5 (62,5%)	8 (30,77%)	2 (33,33%)	
High	3 (37,5%)	19 (73,07%)	4 (66,67%)	
Inflammation: White blood cells				0,097
Normal	7 (87,5%)	14 (51,85%)	2 (33,33%)	
High	1 (12,5%)	13 (48,15%)	4 (66,67%)	
Lymphopenia				0,02
No	8 (100%)	20 (74,07%)	2 (33,33%)	
Yes	0 (0%)	7 (25,93)	4 (66,67%)	
Weight loss				0.316
No	5 (62,5%)	9 (33,33%)	2 (33,33%)	
Yes	3 (37,5%)	18 (66,67%)	4 (66,67%)	
Weight loss				
≤5%	1 (33,33%)	6 (33,33%)	0 (0%)	0,689
Between 5% and 10%	1 (33,33%)	8 (44,44%)	3 (75%)	
≥10%	1 (33,33%)	4 (22,22%)	1 (25%)	
BMI				0.192
BMI <18 kg/m^2	0 (0%)	1 (3,7%)	2 (33,33%)	
BMI 18–25 kg/m^2	4 (50%)	13 (48,15%)	1 (16,67%)	
BMI 25–30 kg/m^2	3 (37,5%)	11 (40,75%)	3 (50%)	
BMI> 30 kg/m^2	1 (12,5%)	2 (7,4%)	0 (0%)	
Hamilton anxiety				0.542
Normal	5 (62,5%)	19 (70,38%)	6 (100%)	
Mild to moderate anxiety	2 (25%)	4 (14,81%)	0 (0%)	
Moderate to severe anxiety	1 (12,5%)	4 (14,81%)	0 (0%)	
Hamilton depression				0.168
Normal	5 (62,5%)	17 (63%)	6 (100%)	
Mild depression	2 (25%)	5 (18,5%)	0 (0%)	
Moderate depression	0 (0%)	5 (18,5%)	0 (0%)	

Table 3 (*continued*)

	MNA Score			p value
	Normal nutritional status (n = 8)	At risk of undernutrition (n = 27)	Proven undernutrition (n = 6)	
Severe depression	1 (12,5%)	0 (0%)	0 (0%)	
Hospital Anxiety and Depression Scale (HADS)				0.992
Normal	5 (62,5%)	16 (59,25%)	4 (66,66%)	
Borderline abnormal	1 (12,5%)	4 (14,82%)	1 (16,67%)	
Abnormal	2 (25%)	7 (25,93%)	1 (16,67%)	
Post-traumatic stress disorder				0.689
No	2 (25%)	9 (33,33%)	1 (16,67%)	
Yes	6 (75%)	18 (66,67%)	5 (83,33%)	
ADL score				0,162
Autonomous	8 (100%)	24 (88,89%)	4 (66,67%)	
Not autonomous	0 (0%)	3 (11,11%)	2 (33,33%)	

case series of 651 and 1141 COVID-19 patients estimated the prevalence of gastrointestinal symptoms at 11.4–16%. This is why it is necessary to regularly monitor food intake (qualitative and quantitative) [23–25].

Faced with the COVID-19 epidemic, urgent mobilization must be instituted in order to identify undernourished patients upon admission and to establish in all COVID-19 patients an active strategy of care or prevention for the least severely affected [26,27].

A positive correlation was found in our between poor nutritional status and the long stay in intensive care (>5 days) ($p = 0.011$) and lymphopenia ($p = 0,02$).

Thus, as in other severe respiratory infections characterized by an inflammatory syndrome and hypercatabolism, an increase in energy expenditure linked to the work of ventilation, leads to a rapid deterioration of the respiratory muscle function, aggravating the consequences of pulmonary damage [21,22].

In severe COVID-19 patients, lymphopenia is common. The immune response and antioxidant defenses are worsened by malnutrition leading to an increased risk of complications. Adequate protein intake is essential in acute infections and malnutrition. Amino acids, and in particular glutamine, are essential energy substrates for immune cells such as lymphocytes [21,22].

The modalities of nutritional treatment in COVID-19 patients are the same as in patients hospitalized for other acute pathologies [26,27].

In the absence of initial undernutrition, the management consists of preventing aggravation by implementing a high-calorie and high-protein diet in COVID-19 patients.

In case of moderate undernutrition, a high-calorie and high-protein diet with oral nutritional supplements between meals will be recommended.

In case of severe undernutrition (or portions consumed $\leq$ 50%), early enteral nutrition by nasogastric tube, unless contraindication should be recommended [24,28].

Thus, the nutritional diagnosis and the early nutritional management of COVID-19 patients must be integrated into the overall therapeutic strategy, as with any acute situation of metabolic aggression. Studies exploring prevention and control measures recommend paying close attention to nutrition, which may contribute to modulating some important consequences of COVID-19 infection, as such pro-inflammatory cytokine storm [29,30].

5. Conclusion

Despite a personalized diet, supplementation with vitamin D and trace elements, 14.6% of patients presented undernutrition. Particular attention should be paid to patients with a long stay in intensive care (>5 days) and lymphopenia.

Authors' contributions

All the authors participated in the care of the patients, the realization of the study, writing of the final manuscript. All authors read and approved the final manuscript.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

Declaration of competing interest

Authors declared they have no conflicts of interest.

References

[1] Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19). Int J Surg 2020 Apr;76:71–6.
[2] Yuki K, Fujiogi M, Koutsogiannaki S. COVID-19 pathophysiology: a review. Clin Immunol 2015:108–427. 2020.
[3] Vellas B, Villars H, Abellan G, Soto ME, Rolland Y, Guigoz Y, et al. Overview of the MNA- its history and challenges. J Nutr Health Aging Nov-Dec 2006;10(6):456–634.
[4] Rubenstein LZ, Harker JO, Salvà A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-fom Mini nutritional assessment (MNA-SF). J Gerontol A Biol Sci Med Sci 2001 Jun;56(6):M366–72.
[5] Guigoz Y. The mini-nutritional assessment (MNA) review of the literature - what does it tell us? J Nutr Health Aging Nov-Dec 2006;10(6):466–8.
[6] Laurence HD. « Présentation du MNA ou MINI nutritional assessment™. Un outil de dépistage et de suivi de la dénutrition ». Gerontol Soc 2010;33(134):133–41.
[7] Raslan M, Gonzalez MC, Dias MC Gonçalves, Castro MN Melina, Marques P, Segatto S, et al. Comparison of nutritional risk screening tools for predicting clinical outcomes in hospitalized patients. Nutrition Jul-Aug 2010;26(7–8):721–6.
[8] Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. China novel coronavirus investigating and research team. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020 Feb 20;382(8):727–33.
[9] Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol 2020 Apr;5(4):536–44.
[10] HAS. Réponses rapides dans le cadre du COVID-19 - prise en charge des patients post-COVID-19 en Médecine Physique et de Réadaptation (MPR), en Soins de Suite et de Réadaptation (SSR), et retour à domicile. Avril 2020:3–5.
[11] Katz S, Akpom CA. A measure of primary sociobiological functions. Int J Health Serv 1976;6(3):493–508.
[12] Hamilton M. A rating scale for depression. J Neurol Neurosurg Psychiatry 1960;23:56–62.
[13] Hamilton M. The assessment of anxiety states by rating. Br J Med Psychol 1959;32(1). 50-5.10.
[14] Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983 Jun;67(6):361–70.
[15] Yao S-n, Cottraux j, Note I, De mey-guillard C, Mollard E, Ventureyra V. Évaluation des états de stress post-traumatique : validation d'une échelle, la PCLS. L'encéphale 2003;29(3):232–8.

[16] Zhu N, Zhang D, Wang W, Xingwang L, Bo Y, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020;382(8):727–33.
[17] https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200921-weekly-epi-update-6.pdf?sfvrsn=d9cf9496_6. [Accessed 24 September 2020].
[18] NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128•9 million children, adolescents, and adults. Lancet 2017 Dec 16;390(10113):2627–42.
[19] De Broe ME, Benghanem Gharbi M, Elseviers M. Maremar, prevalence of chronic kidney disease, how to avoid over-diagnosis and under-diagnosis. Néphrol Thérapeutique 2016 Apr;12(Suppl 1):S57–63.
[20] Rapport de l'Enquête Nationale sur les facteurs de risque communs des maladies non transmissibles. SEPWIS; 2017-2018.
[21] Li T, Zhang Y, Gong C, Wang J, Liu B, Shi L, et al. Prevalence of malnutrition and analysis of related factors in elderly patients with COVID-19 in Wuhan, China. Eur J Clin Nutr 2020;74:871–5.
[22] Thibault R, Coëffier M, Joly F, Bohé J, Schneider SM, Déchelotte P. How the Covid-19 epidemic is challenging our practice in clinical nutrition—feedback from the field. Eur J Clin Nutr 2020 Sep 16:1–10.
[23] Singer P, Blaser AR, Berger MM, Alhazzani W, Calder PC, Casaer MP, et al. ESPEN guideline on clinical nutrition in the intensive care unit. Clin Nutr 2019 Feb;38(1):48–79.
[24] Bouteloup C, Thibault R. Decision tree for nutritional care. Nutr Clin Metab 2014;28:52–6.
[25] Enrik John T Aguila, Ian Homer Y Cua, Joy Arabelle C Fontanilla, Vince Leenard M Yabut, Marion Frances P. Causing. Gastrointestinal manifestations of COVID-19: impact on nutrition practices. Nutr Clin Pract 2020 Oct;35(5):800–5.
[26] Van Zanten AR, De Waele E, Wischmeyer PE. Nutrition therapy and critical illness: practical guidance for the ICU, post-ICU, and long-term convalescence phases. Crit Care 2019 Nov 21;23(1):368.
[27] Barazzoni R, Bischoff SC, Breda J, Wickramasinghe K, Krznaric Z, Nitzan D, et al., endorsed by the ESPEN Council. ESPEN expert statements and practical guidance for nutritional management of individuals with SARS-CoV-2 infection. Clin Nutr 2020 Jun;39(6):1631–8.
[28] Thibault R, Quilliot D, Seguin P, Tamion F, Schneider S, Déchelotte P. Stratégie de prise en charge nutritionnelle à l'hôpital au cours de l'épidémie virale COVID-19: avis d'experts de la Société Francophone de Nutrition Clinique et Métabolisme (SFNCM). Nutr Clin Metab 2020;34(2):97–104.
[29] Butler MJ, Barrientos RM. The impact of nutrition on COVID-19 susceptibility and long-term consequences. Brain Behav Immun 2020;87:53–4.
[30] Cena H, Chieppa M. Coronavirus disease (COVID-19-SARS-CoV-2) and nutrition: is infection in Italy suggesting a connection? Front Immunol 2020 May 7;11:944.