Malnutrition is in general described as an insufficient intake of nutrients or calories for suitable physiological functioning. Undernourishment specially indicates to hypo caloric intake in addition to reduced macro- and micronutrient intakes relative to the calculated recommendation for a patient. Severe malnutrition is defined as less than 50% of estimated energy requirements for more than five days, and moderate malnutrition is defined as less than 75% of estimated energy requirements for more than 7 days. (1) Getting 80–90% of recommended protein and calories in ICU patients is both achievable and is correlated with the beneficial physiological and increase the clinical outcomes in a significant proportion of patients. To maximize these benefits as well as minimizing the risk of enteral nutrition are essential the strategies that should done include early initiation of enteral nutrition (within 24–48 hours), adoption of second-generation feeding protocols, use of motility agents, small bowel feeding tubes, and elevation of the head of the bed. (2) The hospital nutritional care is a pathway that supports the detection, prevention and treatment of malnutrition. Key activities to reach these goals are: Screening, Assessment, nutritional care and monitoring. The post-acute care includes rehabilitation or palliative services that beneficiaries receive following a stay in an acute care hospital. (3)

Depending on the patient’s needs, treatment may include a stay in a facility, such as a skilled nursing facility, inpatient rehabilitation facility (that should be available in our community now as an emergency response to COVID-19), or long-term care hospital, or care in the home via a home health agency, that already found. Coronaviruses (CoVs) are large family viruses that cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). A novel coronavirus (nCoV) is a new strain that has not been previously identified in humans. Nutrition is one of the host factors that correlated with variations in influenza morbidity and mortality. (4, 5) This review aims to discuss the malnutrition among COVID-19 patients.

**METHODOLOGY**

Google Scholar search engine was used to gather information relating to Coronavirus, COVID-19, malnutrition, nutritional assessment, and nutritional care management. The studies were written in English. The period of literature age has extended from the inception of the search engine to the mid of March 2020. The search generated about 297 sources, of which 35 sources were used. These 35 articles were considered relevant because they answered the objectives of the review. The library databases such as PubMed and MEDLINE were also used during the study.

**DISCUSSION**

Patients with COVID-19 have different degrees of psychological pain which they may mild, moderate or severe, such as uncomplicated illness-nanny nose, fever, cough, headache, sore throat, the mild symptoms like breathing difficulty, inflammation in the lungs and the Severe symptoms like acute respiratory distress syndrome and septic Shock.
Nutritional assessment, as defined by the American Society for Parenteral and Enteral Nutrition (ASPEN), uses medical, nutritional and medication histories, anthropometric measurements, physical examination, and laboratory data to characterize the nutritional status of patients. (4) This global approach to nutrition assessment, including dietary history, clinical status, and social history, recognizes the fundamental relationship between nutritional status and severity of the illness. Nutritional assessment helps identify patients who are at nutritional risk, meaning patients who either have actual malnutrition or who have the potential to become malnourished. The best approach involves the use of several parameters for screening patients since no single parameter is a good indicator. The overall consensus of the American Dietetic Association (ADA) and ASPEN recommends two or more of the following six characteristics for the diagnosis of adult patients having either severe or non-severe malnutrition: insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, localized fluid accumulation that can mask weight loss, and diminished functional status as measured by hand grip strength, see figure 1. (5)

Regarding to the SGA the nutrition risk screening is an important step in identifying patients at risk for malnutrition. It is recommended to select a short, valid and reliable form for emergency care. The suitable tool should be used for COVID-19 patient admitted to the words is NRS (2002). Nutritional risk assessment must be also done on all critically ill patients. Malnutrition in intensive care unit (ICU) patients is associated with adverse clinical outcomes. Traditional scoring systems cannot be used for screening in mechanically ventilated (MV) patients, so the appropriate nutritional assessment tool in MV patients is NUTRIC score (modified without ILK-6). This type of screening should be applied by ICU multidisciplinary team. (6, 7)

Nutritional Care Pathway

According to ASPEN Standards of Care for Hospitalized Patients, All patients that admitted to the hospitals should undergo to these steps shown in Figure 2 to know their nutritional status, by dietitians in cooperate with multidisciplinary team. (4)

Energy Calculation

Current energy intake compared with estimated energy requirements is a primary standard in assessing malnutrition. When clinicians obtain the nutritional history and present illness from patients, they should estimate the energy requirements and compare them to the actual energy intake. In state of ICU patients with COVID-19 the energy requirement ERR recommended to be measured by Capnography VCO2 (REE kcal = VCO2 × 8.19), and use a published predictive or weight based (25 – 30 kcal/kg/d) equation to determine energy requirements in state they can’t calculate by indirect calorimetric. (9, 10)

Interpretation of weight loss/physical findings

One standard parameter for evaluating changes in nutritional status involves review of the usual weight of an individual is Ideal Body Weight. (11) The (IBW), a comparison of the patient’s current weight for height to the ideal body weight, can be used as a quantifying tool in the nutrition assessment process. Interpretation of the IBW is as follows: 80-90% IBW is considered mild malnutrition, 70-79% is considered moderate malnutrition, and ≤ 69% is considered severe malnutrition. (9, 11)
Weight comparisons in adults can indicate severity of malnutrition and the percentage of weight lost from the usual baseline weight can be used as a parameter for malnutrition assessment. In adults with acute illness or injury, severe malnutrition is associated with an involuntary weight loss of >2% of usual body weight within 1 week, >5% weight loss within 1 month, and >7.5% weight loss in 3 months. (8) Moderate malnutrition is identified by a 1-2% weight loss within 1 week, a 5% weight loss within 1 month, and a 7.5% weight loss within 3 months. Careful evaluation of other factors affecting weight, such as hydration status, should be reviewed during this assessment. (12)

Protein Intake

Muscle wasting is the most important features for malnutrition; protein energy malnutrition occurred with moderate loss of protein intake especially in the buttocks, temples, clavicles, scapula, clavicles, and calf muscles in severely malnourished patients in critical care units. (13) Nitrogen balance studies evaluate the adequacy of protein intake relative to need. Nitrogen metabolism is dependent on both energy and protein intake, and increasing energy intake often improves nitrogen balance. Increase high-quality protein and branched chain amino acids BCAA such as whey protein and other animal proteins, one of the most important strategies to dealing COVID-19 patient to improve their needs from protein and reduce risk of malnutrition. For that it’s the appropriated target should reaches to 50% of the total protein the range start from 1.2-2 g/kg/24h, it is more beneficial to which can not only significantly inhibit muscle breakdown, but also improve insulin resistance and enhance the efficacy of interferon. (13,14)

Fluid Balance

In hospitalized patients, accurate interpretation of changes in weight can be complex, and clinicians must consider all factors that can contribute to weight changes during hospitalization. In the critically ill patients inflammation may cause fluid shifts which affect the body weight. For example, fluid shifts from the intravascular space to the extravascular space and from the intracellular space to the extracellular space with a concurrent decline in lean body mass can occur in malnutrition with little obvious change in weight. In addition, diuretic and resuscitation therapy, edema, ascites, and other fluid alterations can significantly alter body weight within short time periods and can conceal real changes in body weight. (9, 12)

The minimum amount of fluid for critically ill patients to meet the main nutrient requirements, within limits is 3 ~ 5 mL / kg (calculated as 4 mL / kg) for every 1 ° C increase in body temperature. Most patients with new crown crises have pulmonary edema and fluid accumulation. While maintaining fluid balance, it is even more necessary to prevent excess fluid, especially intravenous fluid volume. (15)

Supplementation (ONS and Vitamins and Minerals)

Oral nutrition supplement should be used whenever possible to meet COVID-19 patient's needs, when dietary counseling and food fortification are not sufficient to increased dietary intake and reach nutritional goals especially in pre-intubated period. The new crown critically ill patients, should a conventional multiple-micronutrient supplementation, in particular vitamin B1, vitamin C, selenium, zinc, as the reference standard normal dosage recommended nutrient intake values. Micronutrients are recommended to be part of total parenteral nutrition management. (16)

Nutrition Support for Malnutrition COVID-19 Patients in ICU

In general the principles of nutrition treatment options and approaches for critically ill patients with COVID-19 start from orally allowed till parenteral in state of worse cases, see Figure 3. (17) According to the recent European Society Parenteral and Enteral Nutrition ((ESPEN)) guidelines on nutritional therapy in Intensive Care Unit (ICU) and the respiratory therapy stages; the nutritional management is guided by the patient's condition. The nutritional management should consider the respiratory support allocated to the ICU patients to prevent the occurrence of malnutrition. (18)

![Figure 3 Principles of nutrition treatment options and approaches for critically ill patients with COVID-19](image)

The enteral nutrition Nasogastric Feeding should be started during the first 24-48 hours of admission. For highly inadequate implementation of enteral nutrition which may result in patient starvation particularly in the first 24 hours of ICU stay and higher risk of malnutrition and associated complications; the peripheral parenteral nutrition may be therefore used under these conditions. (19)

Feeding for malnutrition COVID-19 patient should be initiated with low dose of enteral feeding, that is called hypocaloric or trophic, advancing to full dose EN slowly over the first week of critical illness to meet energy goal of 15-20 kcal/kg actual body weight (ABW)/day (which should be 70-80% of caloric requirements) and protein goal of 1.2-2.0 gm/kg ABW/day. Sometimes the parenteral nutrition is necessary, conservative dextrose content and volume should be used in the early phase of critical illness, slowly advancing to meet the same energy goals as outlined above. (17) While energy requirements can ideally be determined by indirect calorimetry, the principle of “clustering” of care is particularly important and we recommend instead using weight-based equations to estimate energy requirements as a practical matter for the COVID-19 patients. Nutrition requirements should take into consideration the use of propofol in terms of lipid calories and total calories needed. (20, 21)
Common Complication of Suddenly Refeeding Malnourished Patients

Refeeding Syndrome

Refeeding Syndrome defines as a range of metabolic and electrolyte alterations occurring as a result of the reintroduction and/or increased provision of calories after a period of decreased or absent caloric intake. The diagnostic criteria for RS as a follow; decrease in serum phosphorus, potassium, and/or magnesium levels by 10%–20% of normal this mean mild RS, decrease 20%–30% means moderate RS, and >30% and/or organ dysfunction resulting from a decrease in any of these and/or due to thiamine deficiency (severe RS) (22, 23).

Monitoring of malnutrition patient

Effective nutritional monitoring is a vital tool to reduce the incidence of complications, reduce electrolyte and metabolic abnormalities and ensure adequate nutrition is delivered. The frequency of monitoring and parameters measured will be dependent on the diagnosis and underlying clinical condition of the patient; duration and tolerance of enteral feeding; and rationale for feeding. Nutritional monitoring will also vary according to the clinical setting and availability of appropriate expertise. (26, 27)

Nutritional monitoring should be done by suitably trained health care professionals, however patients on long term enteral feeding and their carers should be educated to monitor parameters such as bowels, weight and nutritional intake; identify potential problems; and report concerns to the relevant health care professional as needed. The goals of nutritional support should also be regularly reviewed.

Table 1 Enteral Feeding Monitoring (29)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food chart (if appropriate)</td>
<td>Daily</td>
<td>To compare intake with requirements and aid transition between nutrition support and oral intake. Help assess hydration status.</td>
</tr>
<tr>
<td>Fluid balance charts</td>
<td>Daily in acute setting including fluid delivered by other routes e.g. medications/ IV fluids/ feed flushes and oral fluids.</td>
<td>To assess fluid volume prescribed with volume given. To assess if feed rest periods are adhered to.</td>
</tr>
<tr>
<td>Weight/BMI</td>
<td>Monthly for established home enteral feeding if weight difficult to obtain use mid-arm circumference and tricep skinfold thickness</td>
<td>To assess changes on hydration and body composition over time.</td>
</tr>
<tr>
<td>Temperature/pulse/respiration</td>
<td>Daily when in acute unit</td>
<td>To monitor overall condition and monitor for signs of infection/dehydration. To monitor bowel function and tolerance of enteral feed. To detect hyper/hypo glycemia.</td>
</tr>
<tr>
<td>Bowels</td>
<td>Daily</td>
<td>To ensure timing of feed and medication optimal for blood glucose control. Monitor tolerance of feed.</td>
</tr>
<tr>
<td>Capillary blood glucose</td>
<td>Random daily initially until stable, four hourly if unstable or has diabetes.</td>
<td></td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td>Gastric residual volumes</td>
<td>4 hourly where clinically indicated in acute setting.</td>
<td></td>
</tr>
</tbody>
</table>

Establish BMI, degree of unintentional weight loss in the last 3-6 months, period of little or no nutritional intake, potassium, magnesium and phosphate levels and any history of excess alcohol or drugs such as insulin, chemotherapy, anasthesia and diuretics.

Any one of the following:
- BMI<18.5 kg/m²
- Weight loss >10% over 3-6 months
- Poor intake for 5 days
- Drug history as above
- Low electrolytes

Any two of the following:
- BMI<18.5 kg/m²
- Weight loss >10% over 3-6 months
- Poor intake for 5 days
- Drug history as above
- Low electrolytes

Patient is at risk of refeeding syndrome: refer immediately to the dietitian and/or nutrition team

Ensure adequate thiamine and B vitamins before and during the first 10 days of feeding: consider IV vitamin B preparations (e.g. paclitaxel), or high dose thiamine (500-500mg/day) and Vit B complex 1-2 tablets/day. Seek assistance from dietitians or pharmacists include a balanced multivitamin and trace element supplement daily.

It is recommended monitoring the electrolyte daily


diagram
Monitoring patients on parenteral nutrition (PN) requires a multidisciplinary approach with effective communication throughout the team. This will help to minimise potential complications, and will aid safe, effective and appropriate use of PN. The team should include, at minimum, input from a Doctor, Nurse, Dietitian and Pharmacist, all experienced in PN. (30, 31)

When establishing a new patient on PN, daily review is recommended until the patient is stable in terms of electrolytes, fluid balance and enteral intake. The team should review if PN stopped, appropriately secured, or if PN stopped, appropriately secured. To check for infection/ soreness/ leakage. Check for nasal erosion with nasal placed tubes. If the patient has diabetes, it is important to assess mange and take care of malnourished COVID-19 patients. More research are needed to be analyzed on the interaction of nutritional status on COVID-19.

### Table 2 Parenteral Feeding Monitoring (33-35)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency</th>
<th>To assess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Baseline. Review with growth/degeneration.</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>BMI</td>
<td>Baseline then repeated if dry weight or height changes.</td>
<td>Nutritional status</td>
</tr>
<tr>
<td>Mid-arm circumference</td>
<td>Baseline, then monthly</td>
<td>Estimate body composition and function.</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>Baseline, daily then at each review once stable.</td>
<td>See biochemistry section below.</td>
</tr>
<tr>
<td>Temperature</td>
<td>Daily</td>
<td>Signs of sepsis and review fluid requirements.</td>
</tr>
<tr>
<td>Fluid balance</td>
<td>Daily, then at each planned review once stable.</td>
<td>Hydration and compare nutrition prescribed vs delivered.</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>Baseline, 1-2 times/day then at each review. If has diabetes, follow local policy.</td>
<td>Glycaemic control. Signs of sepsis.</td>
</tr>
<tr>
<td>Clinical condition and medical plan</td>
<td>Daily initially, reducing to twice weekly once stable</td>
<td>Rebound hypoglycaemia if PN timings change or if PN stopped.</td>
</tr>
<tr>
<td>Medications</td>
<td>Baseline then at each review once stable</td>
<td>Whather goals of PN are being met. Nutritional requirements.</td>
</tr>
<tr>
<td>GI function and enteral intake</td>
<td>Daily initially, reducing to twice weekly</td>
<td>Drug-nutrient interactions.</td>
</tr>
</tbody>
</table>

### Table 3 The Typical clinically significant adjustments (34)

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Typical clinically significant adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>Multiples of 40mmol. 50–100+mmol if severe GI losses/short bowel</td>
</tr>
<tr>
<td>Potassium</td>
<td>Multiples of 20mmol. May need 100+mmol/day in severe GI losses</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Multiples of 5-10mmol. May need 15mmol or more in severe GI losses</td>
</tr>
<tr>
<td>Phosphate</td>
<td>Multiples of 10mmol</td>
</tr>
<tr>
<td>Calcium</td>
<td>Multiples of 2.5-5mmol</td>
</tr>
</tbody>
</table>

### Competing interests:
Authors have declared that no competing interests exist.

## Conclusion

It is important to assess mange and take care of malnourished COVID-19 patients. More research are needed to be analyzed on the interaction of nutritional status on COVID-19.

### Reference