



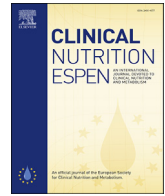
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Opinion Paper

Anthropometric assessment in ambulatory nutrition amid the COVID-19 pandemic: Possibilities for the remote and in-person care



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SUMMARY

Background and aims: The COVID-19 pandemic has caused many changes in the nutritional care process as a result of the social distancing measures imposed, especially in the assessment of nutritional status, in which obtaining anthropometric measures is necessary.

Methods: Critical review of the international anthropometry literature, in the light of the recent scientific evidence of COVID-19.

Results: This paper presents recommendations for anthropometric assessment of the nutritional status of people in ambulatory settings for both remote and in-person assessment. The most appropriate measures to the current pandemic scenario are also discussed, in order to contribute to the monitoring of nutritional status and to minimize health impacts.

Conclusion: When sanitary conditions cannot be guaranteed during in-person encounters or when the person cannot attend the office of the professional, the remote anthropometric assessment can be a useful strategy to nutritional surveillance.

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1. Introduction

The COVID-19 pandemic has brought impacts for the world population, leading to social, economic, environmental and health changes. These effects are caused, in part, by protective measures taken so as to contain the Coronavirus (SARS-CoV-2) transmission, such as social distancing [1], and they may accentuate the complexity and dynamism of the double burden of malnutrition [2,3].

Food insecurity has been increasing worldwide due to multiple factors, such as wage losses, increase in prices, closing markets, decreasing capacity of food production and distribution, disruptions in the supply chain due to lockdown restrictions, interruption of food distribution from social programs, among others

[4–6]. As it worsens the quality of the diet, food insecurity plays an important role as a determining factor in various forms of malnutrition, with young children and women being the most affected [4,7]. In return, malnutrition can favor the progression of the COVID-19 pandemic itself, by weakening the immune system and reducing the ability to prevent and fight diseases [6]. Dietary patterns also have been strongly influenced during the pandemic [8], highlighting the increasing presence of highly processed foods due to their prolonged shelf life, as well as the decrease in the regular consumption of fresh fruits and vegetables due to their restricted storage period, lower availability and higher price in the supply chains of some regions [6,9]. Furthermore, some changes in food consumption were settled as a way of bearing with emotional problems and generating comfort during social distancing and isolation [8,10].

In association, the lockdown measures hinder the practice of regular physical exercises and limit the locomotion of individuals

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throughout the day, favoring idle behaviors such as the excessive use of digital medias and binge eating [8,10], as well as the reduction in cardiorespiratory fitness, and loss of muscle mass and strength [11]. Some studies observed an increase in weight gain, overweight and obesity in adults and elderly people in quarantine, associated with dietary and eating behavior changes [12–14]. This can lead to the development of chronic non-communicable diseases, or even compromise the control and increase the severity of diseases already present, particularly among the most socially vulnerable populations, with lower income and with greater difficulties in accessing public health care services [15].

Thus, in a broader context, everyday life may become more obesogenic, driving the rise of another pandemic, obesity. Recognized as a risk factor for several chronic diseases, such as high blood pressure, cardiovascular diseases and type 2 diabetes, obesity increases the risk of mortality for people diagnosed with COVID-19 [6,16].

On the other hand, COVID-19 may also favor undernutrition directly or indirectly. It is common in symptomatic individuals with reduced food intake due to disorders such as anorexia, dysgeusia, anosmia, hyposmia, pain, nausea, vomiting and others [17,18], which is particularly worrying in some groups, such as the elderly and people with disabilities [19].

It becomes evident, then, the need to periodically monitor the nutritional status and prevent the development and/or worsening of nutrition disorders. In Brazil, for example, there are institutional efforts to strengthen food and nutrition surveillance in Primary Health Care, especially for more vulnerable populations such as traditional communities, low income families assisted by social programs and risk groups for COVID-19 [20].

Anthropometry stands out as one of the main tools for nutritional assessment at the collective and individual levels, for being low-cost, of easy standardization and execution, minimally invasive, and applicable in all age groups and life courses [21,22]. However, in the face of the COVID-19 pandemic, it is necessary to adapt the stages of the nutritional care process to the local reality [23,24]. There are already some recommendations in this direction, such as for nutritional screening [25], comprehensive hospital nutritional management [26], and supplementation protocol during hospitalization [27]. However, there are no guidelines related to the assessment of body composition of outpatients using anthropometry when physical distance is required.

Aiming to fill this gap, this paper highlights preliminary reflections on the use of anthropometry during a worldwide ongoing pandemic, based on scientific information and accumulated professional experience from the authors. Recommendations for anthropometric assessment of the nutritional status of people in ambulatory settings will be presented below: both for the remote assessment, when the person cannot attend the office of the professional, and for the in-person assessment, when face-to-face interaction is required. The most appropriate measures to the current pandemic scenario will also be discussed, in order to contribute to the monitoring of nutritional status and minimize health impacts.

2. Discussion

2.1. Considerations on conducting remote anthropometric assessment

The urgent need for social distancing has led to the suspension of a wide range of activities, including schools, universities, gyms, commercial establishments, medical and dentist offices, and others. This new reality has drastically changed practices in health services, imposing government leaders to provide comprehensive and

urgency solutions to the emerging challenges in the healthcare system [1].

Telehealth, a strategy that incorporates electronic and telecommunications technologies to provide healthcare when distance separates professional and patient [28], rapidly gained visibility and acceptance among health practitioners when physical distancing measures were imposed [29–31]. Such remote encounters can occur as telehealth visits (an appointment with real-time communication using an audio and visual telecommunications system), virtual check-ins (a brief communication via telephone, audiovisual applications, secure text messaging, e-mail) or as e-visits (a communication through an online patient portal).

The nutritional care process was also the target of adaptations and reorganization, and remote appointments have become an alternative way of providing nutritional care and minimizing malnutrition and other diet-related diseases [25]. In fact, the use of anthropometric measures in remote care is potentially promising for geographically dispersed people [32]. They can be obtained remotely using two main strategies: measurement before the appointment without assistance, or measurement during the appointment conducted with the assistance of a professional.

When measurement occurs before the appointment, the time available for the interaction with the professional for nutritional assistance is optimized. However, the professional cannot confirm that the measurements were performed correctly, or even if the values were altered or invented. In addition, prior contact is necessary to carefully instruct the person on how to perform the body measurement techniques in the best possible way considering the available conditions, and in time for the appointment.

When the self-measurement occurs during the appointment, on the other hand, the professional can guide and supervise the techniques step by step in real time, and immediately correct possible errors. However, depending on how many (and which) measures will be taken, the duration of the appointment may increase and this needs to be taken into account in the logistics of nutritional assistance. Besides, even when individuals have access to the equipment needed to carry out nutritional assessments on their own, the quality of these tools may not be satisfactory, and this aspect should also be considered during telehealth.

The decision on how these remote measurements will be obtained must be compatible with the social and health characteristics of each patient, as well as their needs regarding nutritional assistance, and should be preferably defined jointly, so that there is co-responsibility. Therefore, the professional must inquire and discuss with the patient about their reality and possibilities, as it follows.

2.1.1. How will the person engage in the remote appointment?

In cases where the measurement is performed during the appointment with the assistance of the professional, the person must have a cell phone, tablet or computer with a camera, as well as good and stable internet access during real-time video calls. These conditions must be assessed in a contact prior to the appointment.

2.1.2. Is the person able to perform the measurements?

The social and health conditions of the patient (and/or their legal guardian) must be considered, as they can hinder or even preclude the measurements, as is the case of people with reduced mobility or elderly ones who live alone. In these cases, it is important to inquire if another person could assist on the measurements. Also, the person must be motivated and aware of the importance of performing the anthropometric assessment in the most reliable way possible, so that the diagnosis is correct, leading to proper nutritional assistance. Thus, remote measurement is not indicated when there is a high chance that the person will not

engage in the task (e.g. sick or depressed people), may not fully understand what needs to be done (e.g. people with low educational level), will carry out the measurement with little care or in a hurry (e.g. busy individuals), or will even lie about the measurement and/or values (e.g. people ashamed of not having followed the prescription). Videos, podcasts and other simple guidance materials can be helpful to motivate and instruct those who will perform the measurements.

2.1.3. What anthropometric equipment does the person have access to?

Although many people have scales and/or anthropometric tapes at home, this is not the reality for everyone, which would make remote assessment unfeasible. Some may use equipment borrowed from others (relatives, neighbors, friends), but due to the pandemic this may not be possible or even safe. Therefore, the professional must obtain prior information about the technical description of the equipment, such as manufacture (producer, manufacturing material, model), features (capacity, resolution, type of numerical scale), calibration status, place of installation, among others [33]. A checklist collecting this information could be developed to guide the analysis of a professional. When problems that may compromise nutritional diagnosis are identified, such as lack of calibration and poor quality of the equipment, the use of anthropometric measurements obtained by them is inadvisable.

2.1.4. Where will the measurements be taken?

Remote assessment can be conducted with the person at home or anywhere else they feel safe and comfortable. Ideally, during the appointment, the place should be quiet, have good lighting and ensure privacy. Troubled environments can prevent the person from taking measurements calmly and accurately. Also, very small places (e.g. public bathrooms) can hinder the positioning of the smartphone/tablet/computer at a sufficient distance for the professional to adequately monitor the measurement in real time. In the case of appointments with the person away from home (e.g. workplace), the absence of equipment, the infeasibility to change clothes and the lack of privacy can preclude assisted self-measurements.

Considering the above, for assessing the eligibility for remote anthropometric measurement, and defining when it should be performed (before or during the appointment) the possibilities and limits of each person must be taken into account, and not generalized.

In all cases, the professional must take a series of precautions so that the repeated measures have the least external variability possible, considering the importance in monitoring the evolution of the measures over time, such as: standardizing the time of day, location and clothing for performing the measurements; advising on how to use and store equipment to minimize damage and decalibration; making the previous measurements with little or no advance (on the day before or on the same day of the appointment).

2.2. Anthropometric measures for the remote assessment

2.2.1. Weight, height, and alternative measures

Body weight can be very useful to remotely assess changes in usual weight. Regular monitoring is particularly important in the elderly, who have a greater chance of weight loss due to changes in body composition. In children and adolescents, weight gain must also be monitored over time, to favor rapid decision-making, especially in those with a history of nutritional disorders [21]. In adults, in which weight is expected to remain stable, continuous gain can be considered an indicator of nutritional risk and the need for intervention.

Height should be measured to monitor the growth of children and adolescents [16], or in cases where the assessment of the Body Mass Index (BMI, calculated as the weight in kilograms divided by the height squared in meters) is convenient, such as in the presence of comorbidities or increased risk for certain diseases, or to monitor changes in eating behaviors, dietary habits and lifestyle, mainly during the COVID-19 pandemic [12,34]. Even though BMI may have limitations, its use can be very useful for nutritional surveillance under these circumstances [12–14,35,36].

Whenever possible, these measurements should be performed in the presence of another person able to assist. Body weight is the easiest one to be obtained directly in remote assessment, as many people have scales at home, and its measurement technique is extremely simple. On the other hand, height measurement requires more attention. Since an ordinary individual is unlikely to have a stadiometer at home, height can be directly measured on a wall of the household (as long as it forms a 90° angle with the floor and there is not a baseboard). The person should be leaning against the wall in an orthostatic position, a straight and hard material (e.g. ruler, hardcover book, shoe box) can be slid down the wall parallel to the floor axis, until it touches the top of the head. For this procedure, it is essential that the professional provides maximum guidance so that the distance between the vertex and the floor can be correctly marked, or as close as possible to the recommended protocols [21].

When height measurement is not feasible, another possibility is to measure arm span and estimate height using prediction equations. The person must lean their back against the wall and outstretch laterally the arms at the level of the shoulders, maintaining them in contact with the wall and with the palms facing forwards [22]. Then, the point reached by the tip of the middle finger of each hand should be marked, and the distance between these two points must be measured with the anthropometric tape after the person moves away from the wall.

The use of body size measures obtained by self-measurement has been acknowledged as a safe, low cost and non-invasive alternative method to enable nutritional assessment in epidemiological studies conducted with people of different age groups [37,38]. However, their accuracy and reliability at the individual level still deserves further investigation, as they can be affected by many variables, including age, education and socioeconomic status, and therefore underestimate or overestimate nutritional status and lead to bias in important health outcomes [38,39].

2.2.2. Body composition measures

Other anthropometric measures useful for assessing the risk of chronic non-communicable diseases, such as waist and neck circumferences, should be discouraged for remote assessment. The same applies to skinfolds, which are complementary to the assessment of body fat. Even if the person has an anthropometric tape and/or a skinfold caliper at home (which is unlikely), the identification of anatomical points and the measurement techniques are very difficult to be correctly performed by those with no professional training. In addition, the chance of the measurement being repeated over time with minimal variability is very small.

Still, some practitioners are recently deciding to adopt abdominal circumference as an indicator of the evolution of the patient, especially in cases where the person does not have a scale at home. As the anthropometric tape is inexpensive, it can be easily purchased in order to monitor changes in central adiposity and body weight. The abdominal circumference is much more easily obtained than the waist, as it does not depend on the identification of anatomical points of bones to be measured. The person is instructed to pass the tape around the largest circumference of the abdomen [22]. Since there are no consensual cutoff points to

identify risk for chronic diseases when this technique is used, the values obtained should only be used to monitor an increase or decrease in body size over time. However, the risks and benefits of this approach must be considered by the professional, as the quality of such self-performed anthropometric measurement is highly questionable and bound to errors.

Considering the increased prevalence of physical inactivity during social distancing, the assessment of muscle mass loss in all age groups is important, especially in the elderly. In such group, physical inactivity has the potential to deteriorate health, contributing, for example, to sarcopenia and leading to increased morbidity and mortality [40].

However, remote monitoring of muscle mass sometimes can be impractical, or may lead to erroneous diagnosis and, consequently, inappropriate health interventions. The arm circumference, often used for this purpose in people of all age groups, cannot be self-measured, since the technique is complex and requires professional training [22].

Calf circumference, on the other hand, could be used to monitor muscle loss or sarcopenia in the adults and elderly [22,41–44]. With the person sitting on a chair and knees flexed to 90° with the feet resting on the floor, 20 cm apart, the tape should be placed around the calf in a perpendicular plane. Several consecutive measurements must be made by moving the tape up and down to locate the maximum circumference [22]. For people with mobility restrictions to keep in position during the measurement or with any difficulty in reading the value on the tape, the presence of a helper is required. The presence of factors that may interfere with the measurement must be reported by the person, such as edema.

2.2.3. Anthropometric measures of infants and toddlers

Repeated anthropometric measurements are highly recommended during infancy to monitor growth and nutritional status [21,45,46]. This periodic assessment becomes even more relevant in the context of the COVID-19 pandemic, as it is expected to have a negative impact on the health and growth of children, especially those who are malnourished and from countries with high levels of social inequality [7].

The most common anthropometric measurements obtained during infancy are weight and length/height. When resources allow it, both measurements should be obtained because they reflect different growth processes [21,45,46]. However, the acquisition of these measures is a challenge in telehealth. The usual magnitude of weight error is of approximately 240 g [45], but it can be much higher if the protocol is not fully observed (e.g. measuring the child with heavy clothes or diapers) or if the incorrect equipment is used (e.g. scale manufactured for adults). For length/height, the measurement error is of about 0.6 cm when conducted by trained health professionals in health services [45], but following correctly the measurement protocol in a household level can be very difficult since it requires time, training and specific equipment [47], and it results in low accuracy measures. Therefore, it should be sparingly used in telehealth.

For children under 2 years of age, it is preferential that no anthropometric measure should be assessed remotely, since specific professional training is required, and household equipment do not have enough precision to capture small changes [45].

An alternative to assess the impact of the COVID-19 era on child nutrition is the use of remote nutritional screening tools and practical guidance for nutritional care in primary practice, particularly those that do not require anthropometry, such as STRONG-kids [48,49]. Professionals may also consider the use of mobile phone apps that encourage behavior changes to reduce child undernutrition, prevent child/adolescent obesity, and improve health [50–52]. It is also possible to adapt protocols for the use in the

remote follow-up, particularly those based in clinical history, weight changes, food intake, eating behaviors, emotional eating, results of biochemical measurements and other rapid and non-invasive health indicators.

It is important to be aware that nutrition interventions can benefit children but may not discernibly affect linear growth deficits in immediate or intermediate periods. Child nutrition and growth are part of early childhood development; the focus should be to evaluate/improve conditions in which children and toddlers grow and develop throughout childhood and adolescence during pandemic.

2.2.4. Self-reported measures by recall or estimation

The use of self-reported measures based on recall or estimation of body size has been validated [53–57] for use when direct measurements are not possible. It has been shown that the gap between the BMI calculated from body measures obtained directly by the health professional and from self-reported measures by recall has only a mild influence on the clinical evaluation of the patient performed by the professional [36], reinforcing the potential for their use in the remote assessment when direct measurements cannot be taken.

Nevertheless, self-reported measures must be adopted sparingly due to the inherent limitations and risks of error [53,57–61], especially when the goal is to assess changes over time. In general, reporting estimated height tends to be more difficult than weight, especially by adults and the elderly of low resource settings, as their body size is not frequently measured in health services and this could undermine recollection. Reporting the approximate measure of circumferences and skinfolds is not recommended, since they are generally not evaluated very often to be accurately remembered or estimated. Besides, their oscillation over time in response to changes in body composition is not linear or uniform.

In youngsters, the parent-reported measurements of the child have been investigated for the remote nutritional assessment [62]. It was observed reasonable accuracy in parent-reported height and weight of youngsters aged 4 to 11, although the BMI calculated based on these measurements had poor concordance, limiting its use to monitoring growth. According to the authors, this strategy may be a valid method of collecting anthropometric data of children, but future studies with larger sample sizes and repeated measures over time in the context of telehealth research are required. For children under 2 years of age, however, parent-reported measurements should not be employed in remote assessment, as in this age group the weight and length/height gain occurs much faster than in older children [21], and these frequent variations of small magnitude (centimeters and grams) are very difficult to estimate accurately in infants and toddlers.

2.2.5. The use and interpretation of measures in remote assessment

Ideally, all self-measurements should be performed in duplicate, so that the professional can assess the quality of the measure obtained by the person. If the difference between the measurements is greater than expected (0.5 kg for weight, 0.5 cm for height, 1.0 cm for abdomen circumference, 0.2 cm for calf circumference) [22], it is recommended that a third measurement should be performed, and that the average of the two closest should results be used.

Although in clinical practice the selection of the measurements, indices and indicators for remote anthropometric assessment is made by the health professional, it is recommended that in the remote follow-up the emphasis should always be on the evolution over time rather than on the classification of the subject according to cutoff points, considering the overall quality of the serial anthropometric information available either directly by from self-measurement or referred from memory. For this

purpose, questionnaires related to weight changes may be used to verify the impact of dietary choices during the COVID-19 pandemic [12].

However, in some cases this approach may not apply, as in patients with medical conditions that require precise monitoring of nutritional status in the short term (e.g. dialysis, home enteral or parenteral nutrition). Although a position paper recently addressed the everyday care of home medical nutrition during the COVID-19 pandemic [63], recommendations on how to accurately obtain anthropometric measurements continuously from these patients at home have not yet been documented.

2.3. In-person anthropometric assessment

In the need of face-to-face anthropometric evaluation, it is important to maintain effective hygiene measures to protect both the professional and patient [64]. Professionals must be aware of local laws on the operation of offices of health professionals, and should also adopt other specific precautions [65,66]:

- The professional must inform the patient that they must attend the office wearing a facial mask, which should be put on immediately before the consultation starts and after hand hygiene.
- Whenever possible, the professional should ask the patient to go to the office with the appropriate clothes for measurement already on, in order to eliminate the need to use the dressing room.
- Before and after each patient, the dressing room (used by the patient to change clothes, when necessary) and the measuring room (place where the measurements will be taken) must be cleaned with the appropriate products, especially tables, stretchers, furniture, coat racks, light switches, door handles and other surfaces that the professional and the patient may eventually have contact with.
- Before and after each patient, all required equipment and materials must be sanitized with the appropriate products. The use 70% alcohol in gel is suitable for most instruments, but if the professional verifies that such product can deteriorate them, other type of sanitizer must be used.
- Before each patient, professionals must clean their hands with water and soap or 70% alcohol hand sanitizer solution. Then, they should put on a single-use facial mask, and subsequently wear a pair of single-use gloves.
- If the professional has an assistant to help with body measurements, this person must also wear single-use mask and gloves and change them in case of contact with the instruments or the patient.
- Immediately after performing all measurements, professionals must remove the gloves and dispose of them in an infectious waste container, cleaning their hands with water and soap or 70% alcohol hand sanitizer solution, in order to continue the nutritional assistance.

These precautions are based on the recommendations of international health organizations on hygiene and physical distancing during the COVID-19 pandemic. But it is also important to consider the local legislation to address the pandemic, which may vary according to the region and the severity of the epidemiological situation.

Anthropometric measurements should not involve aerosol generating procedures, and therefore, techniques involving deep inhalation and exhalation should be avoided, such as the measurement of height. It is also important that the measurements are carried out in an environment with adequate ventilation, in order

to prevent unintentionally generated aerosols during the appointment from being in suspension for an extended period of time, making them more likely to be inhaled by the professional and/or patient.

Other strategies may also be considered to reduce the exposure of the professional and the patient to contamination, such as increasing the interval between appointments in which there are anthropometric measurements. The number of anthropometric measures to be collected can also be reduced to the essential ones, selected by the professional according to the needs of the patient.

It is important to highlight that the assessment and monitoring of body composition can also be supported indirectly by other nutritional assessment tools, such as semiology (e.g. search for signs of muscle mass loss, looking for evidences of weight gain, using subjective global assessment forms) and laboratory tests (e.g. levels of creatine kinase) However, there are still no studies validating these methods to quantify changes in anthropometric measures, nor validating their use remotely for this purpose.

3. Conclusion

The anthropometric assessment of the nutritional status is an essential step in ambulatory nutritional care, necessary for professional decision-making, even amid the COVID-19 pandemic. It should be preferably performed by a trained professional during in-person encounters, to ensure the proper use of protocols and correct nutritional diagnosis. But when sanitary conditions cannot be guaranteed or when the person cannot attend the office of the professional, the remote anthropometric assessment can be a useful strategy to nutritional surveillance.

Further studies should be carried out to indicate the simplest and most assertive tools to identify nutritional risk and changes in body composition of outpatients using anthropometry when physical distancing is required, as well as to confirm the accuracy of the remote anthropometric assessment for nutritional monitoring.

Author contributions

UVB and KDSRR collaborated in all stages, including conceptualization, bibliographic research, preparation, revision, critical review and approval of the final version of the manuscript. DSB, AAF, DCB, ALMF, RGPSA conducted the bibliographic research, preparation, revision, critical review, and approval of the final version of the manuscript.

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Declaration of competing interest

The authors declare no conflict of interest.

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