EDITORIAL

Are cardiopulmonary exercise testing and bioimpedance variables potential predictors of obesity treatment?

Audrey Borghi-Silva¹, Luciana Di Thommazo-Luporini¹, Lívia P. Carvalho²,³

¹ Cardiopulmonary Physiotherapy Laboratory, Physiotherapy Department, Federal University of São Carlos, São Carlos, São Paulo, Brazil
² School of Physical and Occupational Therapy, McGill University, Montreal, Canada
³ Center for Outcomes Research and Evaluation, Research Institute, McGill University Health Center, Montreal, Canada

We have read the article published by Gruchała-Niedoszytko et al in the Polish Archives of Internal Medicine (Pol Arch Intern Med).¹ The objective of this study was to compare the parameters of body composition obtained by bioimpedance (BIA) as well as the ventilatory, cardiovascular, and metabolic indices derived from cardiopulmonary exercise testing (CPET) between obese and eutrophic patients. Moreover, the study evaluated the effectiveness of a rehabilitation program including exercise, diet, education, and behavioral therapy among people with obesity. In addition, it aimed to identify whether these 2 methods could predict rehabilitation outcomes. The authors concluded that obese patients present themselves with a “pathological fat metabolism and impaired exercise tolerance,”¹ and that changes in BIA and CPET parameters predict the potential impact of rehabilitation with an accuracy of 92%.

Although we consider the study to contribute evidence on the clinical applicability of outcomes in obesity in the context of rehabilitation, we bear in mind that a few aspects must be addressed. These include theoretical concepts and novelty; methodological aspects, especially with regard to reproducibility; interpretability of the findings; and applicability of the results in real-life practice.

Firstly, the authors mistakenly hypothesize that the methods (eg, BIA for body composition or CPET for cardiorespiratory fitness),¹,³ rather than the measures obtained from these methods, are expected to improve the therapy and safety of treatments targeting obesity. It would have been more appropriate if the authors had clarified which measures reflecting body composition as well as exercise capacity would be used as predictors, considering that a substantial amount of variability exists across different methods and conditions both cross-sectionally and longitudinally.

Contrary to oxygen uptake, carbon dioxide production, and respiratory exchange rate, the inter- and intraindividual variability in determining the maximal fat oxidation (FATₘₓ) is considered to be high,⁴ independently of the data analysis approach employed. Regarding the body composition analysis, the bioelectrical impedance may underestimate fat mass and percentage of body fat, especially in longitudinal follow-up in obese individuals.⁵ In this case, predictive values based on this methodology must be interpreted with caution in the context of rehabilitation.

The authors state that lower initial body mass index (BMI) predicts worse outcomes following the rehabilitation program. Focusing solely on BMI at the expense of other patient clinical indicators may be a dangerous therapeutic decision. Individuals with mild obesity (ie, BMI <35 kg/m²) presenting with an unhealthy metabolic profile could feel encouraged not to initiate or postpone participation in a rehabilitation program and, eventually, become more severely obese.

In addition, it is unclear whether the predictive model was based on the Mann–Whitney, as described by the authors, or on the naive Bayes model, as demonstrated in the Results section. Moreover, there is limited information on how categories were classified, as well as whether the classes were equally represented in the model or not. Describing each step significantly reduces bias and improves the accuracy of predictive models⁶ using the naive Bayes classifier and is essential because machine-learning algorithms may not consider the classes imbalance in a dataset.⁷

The authors calculated the naive Bayes model’s odds ratios estimated with regard to the likelihood of achieving a body mass reduction of 5%
or higher or of higher than 10%, but they did not even explain the rationale behind this in the statistical analysis. In addition, no references have been provided for the chosen cutoff points (5% or 10% of weight loss) that determined the success or not of the rehabilitation program. Finally, the interval estimates of the odds ratio are wide, indicating that data are extremely variable, standard errors are large, and/or the population mean is not close to the sample mean, which may indicate that the chosen model may not be the one that best fits the data.

The prediction model and its physiological interpretability, which should be the most important aspect to be emphasized in this study, were poorly discussed. Discrepancies between sex, lean versus obese, and classes of obesity had been much more emphasized than the prediction model and the analysis of accuracy according to the receiver operating characteristic curve. The study design is unclear and the authors did not follow any guidelines to report their intervention, such as the TIDieR guidelines in conjunction with the CONSORT checklist. The information on the rehabilitation program is lacking: which parameters were used to determine the training intensity; adjustments on intensity made throughout the training period; how and which general exercises were performed; changes in diet; education approach; and/or behavioral therapy.

With regard to nutritional intervention, the authors should provide further details on the criteria established for “treatment inefficacy” leading to a transition from a hypocaloric balanced diet to a low-calorie diet, as well as supporting evidence to the effectiveness of using written nutritional diaries as a cognitive behavioral strategy. Because of that, the use of essential information needed for the study to be replicated would be extremely challenging.

Recruitment, retention, and adherence rates are to be thoroughly described. Lack of compliance should not be a contraindication criterion but rather a matter of retention (if prior to study entry) or adherence (if following acceptance to participate in the study protocol). Sample size determination, as a central aspect of prediction models, also requires further details. It is unclear whether it was calculated a priori or a posteriori, which statistical test the authors have chosen to estimate the sample size needed, and what is the relationship with the minimal detectable change observed in Gruchała-Niedoszytko et al and the present study.

Although it is appreciated (and ideal) to provide complex interventions requiring a multidisciplinary team, multiple visits and personalized adjustment during any treatment, we would recommend the authors to reflect upon the feasibility of the implementation of such protocols in a large-scale and standardized way for patients undergoing rehabilitation programs. Considering a dropout rate of 30%, it is worth describing more details with regard to the patients’ report of “lack of time” to participate in the rehabilitation program. Also, the authors state that “extent of the obesity pandemic requires the development of effective methods that can be used across large groups of patients,” which does not seem to be the case of CPET, as it requires a medical team, expensive resources, and well-trained staff.

The use of the FATmax and its associated oxygen uptake and heart rate, instead of percentages of peak values and those obtained at the anaerobic threshold, has been shown to lead to a greater weight loss and metabolic improvements and should therefore be the intensity targeted to optimize metabolic and weight-loss outcomes. We would recommend the authors to clearly acknowledge these controversial findings based on existing literature and provide further details on FATmax determination and its use during this rehabilitation program.

Moreover, further details on the individuals’ previous level of physical activity along with the CPET protocol and determination of exercise intensity (including the special subgroups of patients presenting comorbidities) and progression throughout the laboratory-based phase, would be of utmost importance to comment on the rationale behind using breathing exercises and monitoring heart rate and blood pressure by the patients themselves. Special attention should be given to the running cycles included in the home-based phase of the protocol, and authors should comment on whether this would be feasible and appropriate for the obese population.

Also, the main limitation of the study has not been acknowledged, which is related to the absence of a nonintervention control group receiving usual treatment rather than a population of healthy people performing the obesity rehabilitation program. Finally, originality and novelty are questionable: body composition and cardiopulmonary responses to the CPET in obese and normal-weight people, stratified by sex, have been quite well explored in the literature. Therefore, novel contributions to the existing literature should be very well supported.

Indeed, Primack concluded that there is substantial inconsistency in the design and outcomes reporting of such programs, which makes the comparison of different weight-loss strategies and conclusion drawing very difficult in terms of applicability in rehabilitation centers. Also, there must be a clear differentiation between gender and sex used in the context of rehabilitation programs. Sex refers to the biological characteristics of both men and women and gender refers to their roles in the community, which may differently affect the outcomes under study.

Finally, we suggest the authors to consider more meaningful and complex statistical approaches. Real changes over time and with rehabilitation are more important than comparing preintervention and postintervention changes in means or percentage across multiple
dichotomized independent groups. Real changes observed in pre-post study designs depend on a number of factors, and some criterion is needed to determine a large or small change that cannot be explained by sampling random fluctuations or by measurement error. This amount of change is known as statistically reliable, minimally detectable or reliable change: average-based change approach and individual-based change approach are statistical approaches that should be considered in future studies.

ARTICLE INFORMATION
CONFLICT OF INTEREST None declared.
OPEN ACCESS This is an Open Access article distributed under the terms of the Creative Commons AttributionNonCommercialShareAlike 4.0 International License (CC BY-NC-SA 4.0), allowing third parties to copy and redistribute the material in any medium or format and to remix, transform, and build upon the material, provided the original work is properly cited, distributed under the same license, and used for noncommercial purposes only. For commercial use, please contact the journal office at pamw@mp.pl.


REFERENCES