Editorial Commentary

Insights on strength training, during chemotherapy treatment, for breast cancer

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We read with great interest the article by Vikmoen *et al.* (1) The article is of great relevance, well controlled and elegantly written. Here, we would like to bring some points about the intervention and the results for better comprehension and help in linking research to practice.

Vikmoen *et al.* (1), compared strength training to usual care and found slight increases in muscle strength but no changes in body composition, muscle fiber size, number of satellite cells, and myonuclei. We believe that these results might be related to training characteristics that were not covered in the article, as explained below.

Training volume reached 12 weekly sets for the quadriceps muscles (where the muscle fiber, satellite cell, and myonuclei analyses were performed). Similar numbers of weekly sets are associated with muscle damage and exacerbated edema in beginners (2), conditions that should be avoided since chemotherapy can have negative effects on the satellite cell system and thus on the ability to regenerate muscle tissue (3,4).

Interestingly, Mijwel *et al.* (5) investigated the effects of strength training involving 4–6 sets weekly for the quadriceps in a similar population and reported increases in muscle size and satellite cell count. Vikmoen *et al.* (1) attribute these results to the possible antioxidant effect of the aerobic training conducted alongside strength training, which could mitigate the effects of anthracycline on muscle tissue. However, this hypothesis might be challenged by the fact that inflammation is essential for the activation of satellite cells (6,7).

We believe that a relatively high volume might explain some of negative results in the study and smaller volumes might be more beneficial for this population. In agreement with this, a systematic review and meta-regression of exercise dosage by Lopez *et al.* (8) found that the prescribed weekly volume of resistance training was inversely associated with increases in muscle strength in both the upper and lower body (r^2=98.1–100%; P=0.009). In fact, the increases reported by Vikmoen *et al.* (1) were lower (11%±8%, P<0.001) and upper (10%±8%, P<0.001) when compared to other studies like that of Češeiko *et al.* (9) who reported 20%±8% increases using a lower weekly volume.

Another point that should be addressed is the use of a daily undulating system of 6 or 10 repetition maximum (RM), since the high external load used for 6 RM is often associated with significant mechanical stress and muscle damage (10), factors that might not be beneficial for

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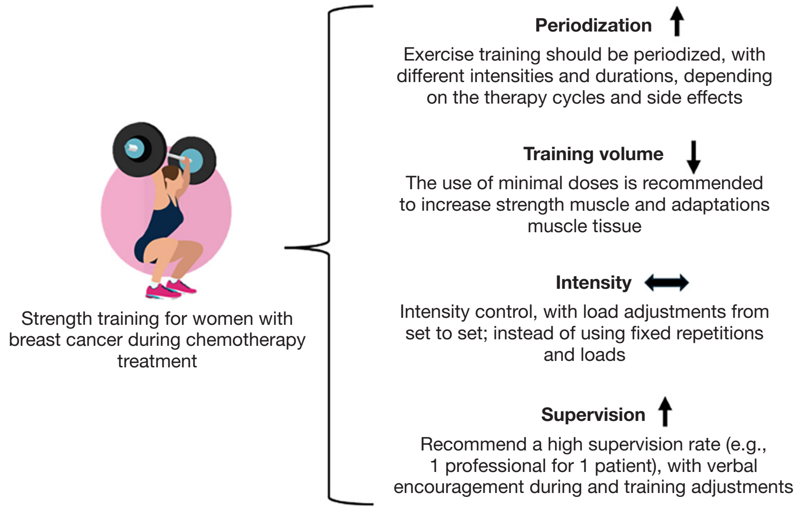

Figure 1 Recommendations to prescription strength training.

individuals undergoing chemotherapy due to the potential negative effects on satellite cells activation (11). We think that the combination of a high volume and high external load might have lead to overtraining/overreaching and could explain the observed trend for a reduction in satellite cells myonuclei per muscle fiber in type I fibers in the strength training group.

Additionally, another aspect that may have interfered with the magnitude of the results was the use of fixed repetitions and load (6 or 10 RM) with 1 RM test conducted in week 5 to determine the weight used in exercises until the end of the study (week 16). This prescription model presents some inherent weaknesses, in controlling intensity and load progression, since muscle performance constantly fluctuates over sessions and within a session. In fact, it has been previously shown that protocols using fixed loads and repetitions results in lower muscle strength and hypertrophy when compared to protocols with constant load adjustment based on repetitions range (12).

It is important to note that the divergence of results in muscle morphology and strength are not unexpected, since the initial increases in muscle strength in response to training are mainly neural, dissociated from muscle hypertrophy. However, we should not disregard the importance of muscle hypertrophy in cancer patients, since lean mass loss and recovery are closely associated with mortality risk (13,14).

In addition to the contributions presented by Vikmoen *et al.* (1), based on previous research, as well as our clinical experience, we would like to bring some insights and suggestions for those working with similar populations (*Figure 1*).

Periodization: the adverse effects of chemotherapy with anthracyclines and taxanes on muscle strength, body composition, functional capacity, and fatigue, among others, are widely known (15,16), with possible complications such as nausea, vomiting, diarrhea, and severe fatigue immediately after and in the days following drug administration (17). Based on this, it has been suggested that exercise training should be periodized, with different intensities and durations, depending on the therapy cycles and side effects (18). An example is reducing volume and intensity in the day following chemotherapy and progressively increase in the days after.

Training volume: the relation between training volume and muscle strength and hypertrophy seems to have an inverted U shaped curve (19,20). Considering the effects of cancer treatment, this curve might be more left-sided than in other situations. Therefore, the use of minimal doses may be recommended. Programs with low training volume performed once a week have shown significant results in muscle strength in women post-chemotherapy (21).

Intensity: it has been shown that performance decreases from set to set, resulting in a need to change load or number of repetitions (21). Therefore, we recommend using intensity of effort (22) or velocity loss (23) to control intensity, with load adjustments from set to set; instead of using fixed repetitions and loads.

Supervision: we strongly recommend a high supervision rate (e.g., one professional for one patient), to improve the results (24). This is useful for many reasons, as verbal encouragement during and training adjustments.

Additionally, considering the relevance of exercise interventions for this population across several parameters not addressed here, we suggest that similar studies also use scales such as the ORBIT model, which incorporates affective regulation, contributing to the development of effective interventions according to the variables to be evaluated and the characteristics of the population, such as women undergoing cancer treatment or other diseases (25).

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Footnote

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