

EFFECTS OF OBESITY ON SINGLE STEP BALANCE RECOVERY FROM A FORWARD FALL

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INTRODUCTION

Falls are a major medical problem in older adults due to high fall rates and a greater likelihood of injury and death from a fall. Obesity has the potential to exacerbate this problem, but little is known about its effect on the ability to prevent falls (Wearing 2006). To address this gap in the research, this study investigated the effects of obesity on single step balance recovery from a forward fall. In addition, the effect of obesity on the relative strength required during single step balance recovery was investigated.

METHODS

Sixteen subjects participated including eight obese adults (age = 64.9 ± 5.4 years, BMI = 33.2 ± 2.4) and eight age- and gender-matched non-obese adults (age = 64.0 ± 6.4 years, BMI = 24.8 ± 1.8). Subjects were initially released from a static forward lean of 10 degrees, and attempted to recover their balance with a single step. Upon successful balance recovery, the task was repeated with progressively larger lean angles until the largest lean angle that could be recovered from upon release was determined. After a brief rest, subjects performed a battery of muscle strength tests on a Biodex System 3 dynamometer to determine the maximum isometric joint torque that could be produced at each joint of the lower extremity.

Sagittal plane joint torques in the lower extremity were estimated for all trials using a

2D rigid-link model and inverse dynamics analysis. Joint torques were then normalized to peak joint torques measured during strength tests to express joint torques as a percentage of their maximum values (i.e. relative joint torques).

RESULTS AND DISCUSSION

The maximum lean angle achieved by the obese subjects (13.75 ± 3.54 degrees) was smaller ($p=0.024$) than that achieved by the non-obese subjects (18.13 ± 2.59 degrees) (Figure 1).

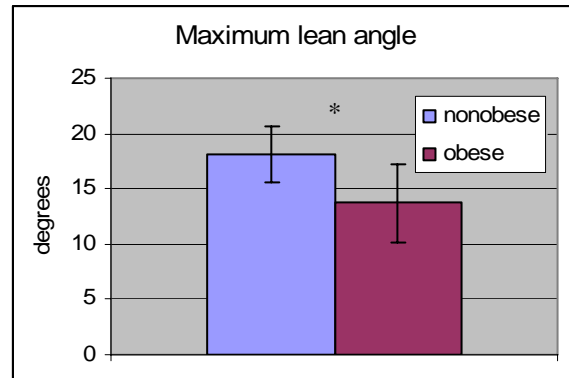


Figure 1. Maximum lean angle for both non-obese (left bar) and obese (right) subjects. Error bars represent standard deviation. * indicates $p < 0.05$.

This suggests that obese subjects have a poorer ability to recover from a forward fall with a single step.

No differences in peak knee or hip extension torques during recovery from a 15 degree lean angle were found between the groups ($p > 0.05$). However, peak ankle plantar

flexion torque was higher in obese subjects as compared to non-obese subjects ($p=0.035$) (Figure 2).

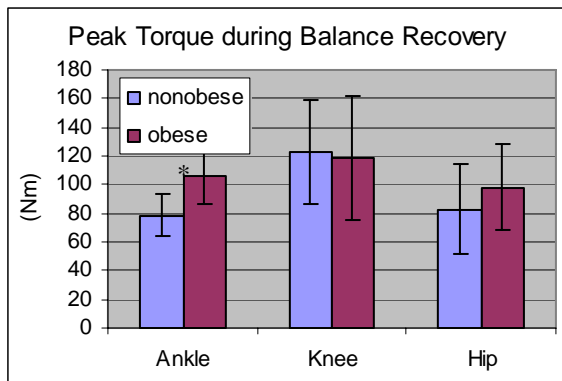


Figure 2. Peak joint torque during balance recovery for both non-obese (left bars) and obese (right) subjects during recovery from a 15° lean angle. * indicates $p < 0.05$.

Similarly, no differences in peak knee or hip extension relative torques during recovery from a 15 degree lean angle were found between groups ($p > 0.05$). However, peak ankle plantar flexion relative torque was higher in the obese subjects compared to the non-obese subjects ($p = 0.35$) (Figure 3). This suggests that the obese used a larger percentage of their maximum ankle plantar flexion joint torque during recovery from a forward fall compared to non-obese subjects.

It should be noted that some of the peak relative torques were above the theoretical maximum of 100% strength estimated by the MVC. This was likely attributed to sub-maximal effort during strength tests.

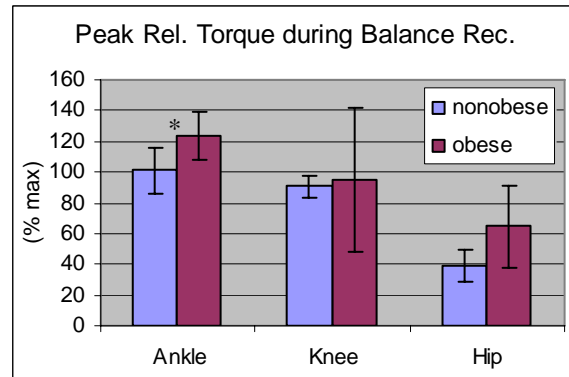


Figure 3. Peak relative joint torque during balance recovery for both non-obese (left bars) and obese (right) subjects during recovery from a 15° lean angle. * indicates $p < 0.05$.

SUMMARY

In conclusion, obese subjects exhibited a poorer ability to recover from a forward fall with a single step, and used a higher percentage of their total ankle strength compared to non-obese subjects. Obese subjects also tended to use a higher percentage of their total hip strength, but this did not reach statistical significance. Considering these results together, they suggest that the poorer ability of recovering from a forward fall in the obese may be related to increased exertions levels during balance recovery.

REFERENCES

Wearing, SC et al. (2006). *Obesity Reviews*, 7:13-24.

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