INTRODUCTION
Increased BMI is a known risk factor for the development of knee osteoarthritis (OA) [1]. Women in particular are at an increased risk of developing OA when they reach 40 to 50 years of age [2]. The link between excess body mass and cartilage wear has long been assumed but relatively few studies have looked at the biomechanics of persons with high BMI, especially before the onset of OA [3]. The external knee adduction moment (KAM) has been linked to both the severity and progression of OA as it is an indirect measure of medial compartment loading [4]. The purpose of this study was to examine the relationship between BMI and KAM during walking in healthy women at an age just prior to increased risk of knee OA.

METHODS
A total of 16 pre-menopausal women between 35 and 45 years of age were analyzed for this study. Participants had no self reported knee pain or history of knee injury and completed the Western Ontario and McMaster (WOMAC) osteoarthritis index questionnaire.

Participants were recorded while walking at their normal self-selected pace along a 6 m runway. Lower limb kinematic data were collected using an 8 camera 3D motion capture system (F-20, Vicon Motion Systems, CO, USA). A force platform embedded in the runway was used to collect ground reaction forces (OR6-7, AMTI, Watertown, MA, USA). A combination of static and functional calibration data were used to estimate hip, knee and ankle joint centres. Segmental inertial parameters for each participant were estimated using whole body dual-energy X-ray absorptiometry scan data and geometric models. Inverse dynamics techniques were used to calculate the KAM during the stance phase and the first KAM peak was identified for each trial (Figure 1). Data were collected for both left and right limbs with 6 successful trials averaged for each limb. Limb data were combined by averaging to obtain a single value for each participant.

For analysis, participants were divided into two groups based on BMI (Normal: <25 kgm\(^{-2}\), n=10; High: >30 kgm\(^{-2}\), n=6). Independent t-tests were used to compare between groups. Significance was set at p<0.05. KAM data were expressed both normalized to body mass*height and in absolute form.

RESULTS
No differences were found between groups for age, stride velocity, and WOMAC score (Table 1). In the High BMI group, the absolute peak KAM value was significantly larger and the normalized peak KAM was significantly smaller compared to the Normal BMI group (Table 1).

![Figure 1: Average and SD of absolute stance phase KAM for the Normal (solid/grey) and High (dots/hatched) BMI groups.](image)

DISCUSSION & CONCLUSIONS
This study is one of very few to examine the relationship between KAM and BMI in adults without OA [3]. A unique aspect of this study is the similar self selected walking speeds between the Normal and High BMI groups. In previous studies, increased BMI has been associated with lower self selected speeds which can confound moment data. In the current study increased BMI produced an increased peak absolute KAM which is consistent with several studies. However, our results also show an inverse difference in normalized KAM values, which might be expected but is less common in the literature. Both differences have not been previously reported in the same study. The difference in normalized KAM suggests that persons with high BMI may be adopting a strategy to reduce medial knee compartment loading. The mechanics of this strategy have yet to be fully understood.

REFERENCES