**Aim 2 : Effects of COM when carrying a load**

The aim of this section is to study the metabolic cost and joint kinematics of carrying loads in different positions along the sagittal plane while walking up various slopes. We hypothesize that the further the load is moved from the mid-coronal plane along the sagittal plane, the greater the metabolic cost will be. We suspect that the increases in metabolic cost will be primarily due to the changes in the musculoskeletal geometry to balance the new COM.

When analyzing the human gait as an inverse pendulum, the individual’s COM must reach an apex halfway through the stance phase to move forward. When the COM is moved forward or backwards on the sagittal plane, the individual must adjust their body position to stay balanced, then use this new position to walk. Previous studies indicate that most of the repositioning when the COM is moved along the sagittal plane takes place at the pelvis or at the ankles [14,21,22]. These adjustments to the musculoskeletal geometry will affect the forces acting on the muscles, hence affecting metabolic consumption. This experiment will analyze the joint kinematics and metabolic cost of moving the individual’s COM forward and backwards on the sagittal plane.

This experiment will have each participant walk at 1.0 m/s on a treadmill at 0°, 4°,8°, and 12° with three different loading conditions. Each loading condition will have a weight of 10% of the subject’s weight. The first condition will have the load carried in a bilateral backpack on the back, the second condition will have the same loaded backpack on the participants front, and the third condition will be splitting the load between two backpacks, one on the front and one on the back. We will make sure that the backpack(s) is positioned at the same height in every condition. During these trials, we will be collecting the ground reaction forces, O2 consumption, and CO2 output which will be used to calculate the metabolic cost of each condition, and where the body is adjusting its positioning for the different COM’s. We expect that the metabolic cost will be higher when the load is carried on the front or the back compared to being distributed between the two. When the load is on the back, we expect the participants to have a forward pelvic tilt, and a forward lean at the ankles. When the load is on the front, we expect a backwards tilt at the participants’ pelvis.