

#42 Selecting Yoga Asanas for Older Adults: Biomechanical Considerations

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Objective: Yoga has been promoted as a safe and effective exercise program, capable of increasing the strength, flexibility, and functional capacity of older persons. However, little is understood regarding the musculoskeletal demands of Yoga asanas. This information is important for safe participation, particularly in older adults. The purpose of this study was to determine the relative physical demands associated with 5 common Yoga asanas, using biomechanical methods.

Methods: Three healthy older women (61-75 yrs) performed 5 asanas, chair, tree, warrior I, supported cobra, and bridge, while instrumented for biomechanical analysis. Joint moment of force (JMOF) for the ankle, knee, hip, shoulder, elbow, and wrist were obtained by an eight-camera motion analysis system and force platforms. To determine the relative physical demands among the asanas, an 11-point (0-10) scale was used to fit the data range of JMOF produced across all participants and asanas. The normalized JMOF for each asana at each joint was then calculated and ranked.

Results: The chair pose generated a relatively large extensor JMOF across the hip (~70% of maximum) and knee joints (~50%), but a relatively smaller JMOF at the ankle (15%). The hip JMOF (~90%) for the warrior pose was strongly dependent upon the limb that was measured (forward vs. trailing) but the knee JMOF for this pose was not. At the ankle, the warrior trail limb required the greatest frontal-plane moment suggesting that this exercise might be useful for balance training. The tree pose was best at targeting the ankle plantar-flexors, which are important power generators during gait. This asana also generated the greatest knee abductor JMOF, which could be potentially detrimental to the supporting structures (e.g. ligaments). Among all the poses, cobra not only placed the greatest demands on the shoulder abductors, elbow extensors and wrist extensors, but also on elbow and wrist abductors. Anterior-posterior alignment should be emphasized while performing this asana to avoid injury risk.

Conclusion: Based on these biomechanical data, selecting poses that are most likely to achieve targeted training gains while minimizing detrimental joint loading and injury risk can be achieved. When needed, asana modifications are advised to decrease potential detrimental JMOF, especially for older adults with musculoskeletal limitations.

#44 The Effects of a University Yoga Class on Nutritional Habits of Students

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Keywords: Yoga, Nutritional Habits

Objective: The purpose of this study was to look at the eating habits of university students and to determine if these habits could be positively impacted by participation in a 10-week yoga class. **Methods:** Seventy-nine university students, 72 females and 7 males were asked to fill out a questionnaire pertaining to nutritional habits. The questionnaire asked questions such as, "How many sodas do you drink per week?" and "How many times per week do you eat fast food?"

The students then took a 10-week yoga class, twice a week for 90 minutes, in the tradition of T. Krishnamacharya. This style of yoga has a heavy emphasis on the synchronization of breath and movement. At the end of the 10-week quarter, each student was asked to fill out the same questionnaire regarding nutritional habits. Data was analyzed using SPSS 14.0 with paired-sample t-tests at a 95% confidence interval.

Results: Results showed that many of the nutritional habits of college students were impacted positively by taking the 10-week yoga class. Water intake was impacted significantly. The average beginning number of eight-ounce glasses per day were 3.4 and the ending number of eight-ounce glasses per day was 4.3, $t(71) = -3.7$, $p < .000$. Vegetable intake went up significantly from 1.1 to 1.6 (1/2 cup) servings per day. The t-value was $t(71) = -4.1$, $p < .000$. Fruit intake followed a similar pattern. At the beginning of the quarter the average was 1.4 (1/2 cup) servings per day, $t(71) = -4.4$, $p < .000$. The amount of soda was reduced significantly, beginning at .67, 12-ounce sodas per day and ending the quarter at .34, 12-ounce sodas, $t(71) = 3.7$, $p < .000$. Coffee followed suit with respect to 8-ounce servings. Students reported drinking .41 servings of coffee at the beginning and .26 servings after 10 weeks of yoga class. The t-value for coffee intake was $t(71) = 2.0$, $p < .05$. Last, reported number of sweet treats was reduced from 1.8 servings per day to .96 per day. This was statistically significant at the .000 level, $t(71) = 5.4$, $p < .000$.

Conclusion: These data demonstrate that a twice a week group yoga class does have a significant impact on the nutritional habits of university students in terms of increased water intake, increased fruit and vegetable intake, reducing sodas and coffee as well as sweet treats.

Asanas for Older Adults

The truth is we are all getting older – individually and collectively. As the population of older adults expands, it's important to consider what poses are safe for the older, wiser generation. It's possible to measure the biomechanical effects of poses on the joints to determine the risks and rewards of poses. This also gives insight into what modifications are appropriate to take a traditional asana and change them to make them more accessible and effective for healthy older adults. This was the goal of the YESS, Yoga Empowers Seniors Study.

First, we did small sample study, aka a pilot study. In our pilot we looked at 5 poses that are regularly taught in senior yoga classes: chair, warrior 1, tree, cobra and bridge. Here's a summary of the initial findings from the pilot in plain English:

Chair pose had the most muscular activation in the hip extensors and hip stabilizers. No surprise here. There was some concern on the joint load for the knees and hips. This is important to consider for OA, osteoarthritis, in these weight-bearing joints. Chair can be modified by limiting how deeply you "sit" back in your "chair." Also, sitting back with the hips on the wall, lessens the load on the hips and knees. And it eliminates strain/load on the lower back.

Warrior 1 had high "moments" or muscle activation in the frontal plane of the ankle joint, which is important for ankle stabilization and the ever important balance for older adults. (In the full study, concerns were raised about hyper extending the front knee. See "Peaceful Knees in Warrior 1" for more on this.)

Tree had the greatest activation of plantar flexion in the standing leg, which is important in gait propulsion, where some of the power in your walk originates. But there was concern about knee abduction, ie, lateral pressure on the knee. In the full study, we examined several versions of the tree pose to determine how to do it safely. See "Wisdom of Trees" for more on this.

Cobra created some concerns in the shoulder girdle and wrists in this pilot. Although, considered one of the "baby backbends," cobra is a pretty complicated pose for older adults. We placed a blanket underneath the torso right at the hip crease and covering the lower ribs. This has two benefits: protect the lower ribs for those with osteoporosis and help protect against lumbar compression by creating a slight hip flexion. (Many older adults do not have even neutral hip extension.) And we modified the pose by taking hands wider than shoulder distance and closer to the head than in the traditional pose. This makes the pose more accessible for the shoulders. Cuing to only use the hands for spinal extension versus using the hands to lift the chest is also important to prevent wrist compression. A great way to teach the actions of cobra in a way that is more safe and accessible is teaching the actions of the shoulder girdle while standing. Teach the lumbar stability with a block between the inner thighs. Then take students right up to the wall, facing the wall, and use the wall like the floor. Students can find the right hand placement, feel how

to use the hands to lengthen the spine, and practice engaging the abs to support the lumbar spine while opening the chest. So when they get on the floor, they have an imprint for how to make the pose their own and will have much more success.

The following abstract doesn't mention the bridge pose. Nothing unexpected was learned about the bridge pose in this pilot.

All of these poses and many more were studied in YESS. For a complete list of all of the poses and modifications we used In the full YESS program with lots of details on the protocol, see: <http://www.geronet.ucla.edu/yess>

To see the abstract published in IAYT, International Association of Yoga Therapy, in a more complicated version of English, read: #42 Selecting Yoga Asanas for Older Adults: Biomechanical Considerations.