Strength for Balance in Older Adults

When you think of improving balance, you probably think of balance poses. Practice makes – well, not perfect, but definitely improvement. AND you also want to begin an asana practice with poses that develop the strength to support balance poses. YESS (Yoga Empowers Seniors Study) data shows that chair and modified downward dog poses are effective to cultivate strength for older adults.

Utkatasana or chair pose is also sometimes called the fountain of youth. This paper from the YESS study indirectly explains the science behind this nickname. Of all of the poses used in this study, chair pose has the greatest potential to strengthen the hip stabilizers. This means the muscles that are deployed to catch yourself from falling get the most engagement, ie, strengthening. Since fear of falling is the number-one concern of older adults and since falling can lead to hip replacements, nursing homes and worse, "fountain of youth" is apt. And since sitting in a chair is what most of us are doing most of the time, "fountain of youth" can be an inspiring metaphor for this challenging pose.

Not surprisingly, in the modified dog pose, the study revealed that participants were not engaging their quadriceps muscles. (Although they were using their peroneals, which are also important for balance.) For students who have OA, osteoarthritis, this lack of quad engagement can create compression in the knee joint. Solve this issue with actions/cues such as "lift all 10 toes up while firmly pressing the balls of the feet down and feel how the knee caps lift up." This will strengthen the quads and invite students to feel what is happening. Thus you will gain strength, proprioception and personal empowerment in your practice.

Then move on to simple balance poses, such as Tree Pose. And also check out the research article for "Wisdom of Tree Pose" as well as "The Truth about Dogs" research article.

Now you have the layman's explanation. For the scientific, technical version, put your nerd cap on and read, Biomechanical Demands of /therapeutic Hatha Yoga poses in Older Adults: Modified Chair and Downward Facing Dog.

BIOMECHANICAL DEMANDS OF THERAPEUTIC HATHA YOGA POSES IN OLDER ADULTS: MODIFIED CHAIR AND DOWNWARD FACING DOG

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INTRODUCTION

Yoga has become one of the most commonly used complementary and alternative medicine therapies in the United States. Based on the National Health Survey, yoga participation jumped 40% from 1997 to 2002 and the total population who participated in yoga in the past 12 months reached 13.2 million in 2007 (Barnes, 2004; Barnes, 2008). Chair (CH) and downward facing dog (DFD) are two of the most frequently practiced yoga poses and props such as a wall, chair, and/or blocks are often used to modify the poses in order to maintain proper alignment of the body, especially for those who have limited strength and flexibility, such as older adults. However, the poses performed with props have never been examined biomechanically and no information regarding the musculoskeletal demands of these activities has been reported. The purpose of this investigation was to characterize and compare the kinematics and kinetics of the modified CH and DFD poses, performed with a wall.

METHODS

Twenty-four independent older adults (70.8 ± 4.1 yrs) participated in a 32-week Hatha yoga program, twice per week. Baseline biomechanical measurements were taken after 2 weeks of introductory classes, where the subjects practiced the yoga poses. The program was designed to improve strength, flexibility, and balance for older adults and was led by a yoga instructor, experienced in teaching seniors. At the baseline visit, subjects performed the poses while instrumented for biomechanical analysis. Reflective markers and tracking marker plates were placed on subject's bony landmarks (head, trunk, pelvis, upper extremities, and lower extremities (LE)) to define each body segment. Subjects then went through breathing exercises, a short warm-up session, and then performed the yoga poses while guided by the yoga instructor. During data collection, a plexiglas wall was used for support (Fig. 1). To perform the modified CH, subjects stood with their back approximately one step distance from the wall, their feet hip-width apart, and a block held between their inner thighs. The subjects then brought their arms overhead, while flexing their knees and hips to a self-selected maximum depth, where they could safely and statically hold the pose while completing a full breath. The subjects then returned to the starting position. To perform the modified DFD, the subject stood approximately a forearm's length from the wall with their feet hip-width apart, and their hands placed on the wall at the level of their shoulders. They then stepped back as far as safely possible from the wall while extending their elbows, flexing their shoulders, and flexing at their hips. Their hands remained in contact with the wall at all times. They were instructed to hold the position during a full breath, while keeping their elbows extended and their spine in a neutral position (Fig. 2). They then returned to their starting position.

Whole-body kinematic data were collected using an 11-camera motion capture system at 60 Hz (Qualisys; Gothenburg, Sweden). Ground reaction forces were recorded through force platforms at 1560 Hz (model #OR6-6-1000, AMTI, Watertown, MA). Joint moments at the hip, knee and ankle, in the sagittal and frontal planes, were calculated using standard inverse dynamic techniques. Two successful trials were collected for each pose and the average joint moments and angles produced over the 2 trials were computed. Baseline data from the dominant limb are reported here.

Paired t-tests were used to test for differences in LE joint angles and moments between the 2 poses. Cohen's effect sizes (*d*) are provided.

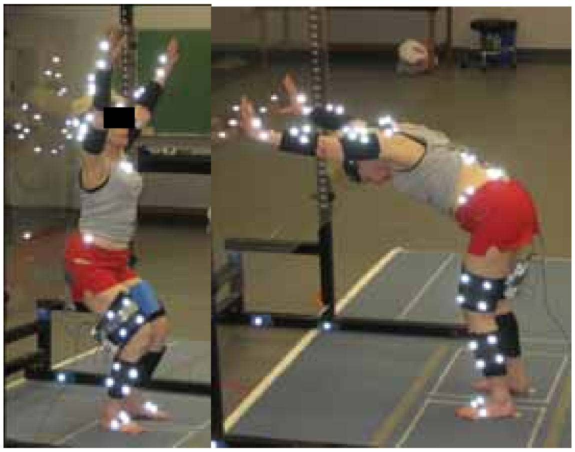

Figure 1 & 2: Modified CH (left) and DFD (right) poses performed with a plexiglas wall.

RESULTS AND DISCUSSION

There were statistically significantly differences in sagittal plane joint angles at the hip (d = -1.93) and knee (d = 2.15) between CH and DFD ($p < 0.001$, Table 1). Knee abduction angle was also significantly greater in DFD than CH ($p < 0.01$, d = -0.53). Both poses had statistically significantly different moment profiles at the hip, knee, and ankle in the sagittal plane ($p < 0.01$, d = 1.58, -2.72, and 1.08, respectively; Fig. 3) and frontal plane ($p < 0.001$, d = 2.5, 7.57, and -1.67, respectively; Fig. 4). Both DFD and CH generated extensor moments at the hip and ankle. Conversely, at the knee, CH generated an extensor moment while DFD generated a flexor moment. This finding suggests that CH should be selected over DFD when the goal is the strengthening of the quadriceps. In the frontal plane, CH produced abductor moments at all three LE joints, whereas DFD produced adductor moments at the hip and knee. The results suggest that CH may be more effective in training the hip abductors whereas DFD may be more effective in training peroneal muscles - important muscle groups for maintaining balance in older adults. Although both poses generated potentially unfavorable frontal plane moments at the knee, the magnitude was greater during performance of the DFD. These findings should be considered when using these poses in seniors with knee OA.

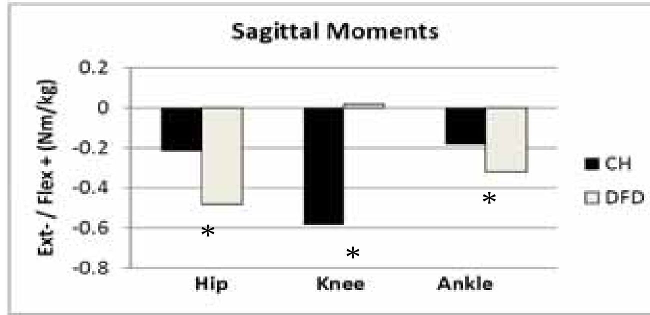

Figure 3: LE joint moments in the sagittal plane during CH and DFD poses. *$p < 0.01$.

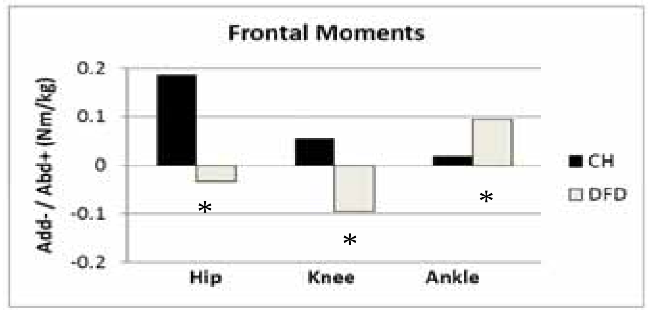

Figure 4: LE joint moments in the frontal plane during CH and DFD poses. *$p < 0.001$.

CONCLUSIONS

Both DFD and CH appear to be effective at targeting the extensor muscles of the hip and ankle. To strengthen the quadriceps, CH may be more appropriate than DFD. Both CH and DFD appear to target important muscle groups for balance training (CH targeting the hip abductors and DFD targeting the peroneal muscles). DFD may be more detrimental to the knee joint as compared to CH in those who have knee problems.

REFERENCES

1. Barnes PM, et al. *Adv Data* **27**, 1-19, 2004.
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Table 1: Lower-extremity joint angles during modified CH and DFD poses

	CH			DFD		
Joint Angle (deg)	Hip	Knee	Ankle	Hip	Knee	Ankle
Flex (+)/Ext (-)	50.8 ± 15.8	54.7 ± 13.1	13.7 ± 6.4	83.1 ± 17.6*	26.1 ± 13.5*	12.6 ± 6.4
Abd (+)/Add (-)	-0.2 ± 4.1	1.3 ± 5.4	3.0 ± 4.7	-1.1 ± 5.6	4.0 ± 4.8#	3.6 ± 3.6

*Significantly different between CH and DFD ($p < 0.001$). #Significantly different between CH and DFD ($p < 0.01$)