EFFECTS OF LEISURE SPORTS PARTICIPATION PERIOD ON BALANCE AND THE LOWER EXTREMITY ASYMMETRY

Mi Sun Kim[1], Se Jin Kong[2], Gizem Ozkaya[1], Min Young Shin[1], Lin Xue[1], Ki Kwang Lee [1]

Kookmin University, Seoul, Korea[1]
LS Networks, Seoul, Korea[2]

The aim of this study was to investigate the effect of the sports participation on balance measurements and lower extremity symmetry. Eighty healthy middle-aged adults (male 35, women 45) were participated in this study. COP related variables were selected for both double and single leg standing as center of pressure anterior posterior (COP_AP) and medial lateral (COP_ML) displacement, center of pressure mean velocity (COP_MV), center of pressure area (COP_Area), and the symmetry index (SI) of dominant and non-dominant leg. Only the COP_MV showed statistically difference for both double and single leg standing test. However, no significant differences were observed for single leg standing asymmetries. As a result, long term sports participation has positive effects on balance which can be helpful to prevent falls in middle-aged adults.

KEY WORDS: center of pressure, mean velocity, symmetry index.

INTRODUCTION: Center of pressure(COP) is a reliable and validated variable which primarily used to evaluate the balance (Boyas et al., 2001). COP related variables has been used commonly to evaluate the effects of the exercise program, neurological disorders, orthopedic disorders, aging (Dolye et al., 2007). It has been reported that the increased mean velocity of COP is a sign of decreased balance or postural control (Adlerton et al., 2003). Decreased of the balance can cause serious restrictions during daily living, therefore it can be a major cause of falling caused injuries and death in the elderly (Pentland et al., 1986; Baker & Harvey, 1985). Aging has effect on balance impairments and control (Manor et l., 2010), caused by the decreases on the overall physical strength and sensory functions due to physiological degenerations of human body (Winter, 1990). Double and single leg standing tests with eyes open and closed were used as clinical measures to assess the people with a wide range of balance disorders in previous studies (Doherty et al., 2014; Frzovic et al., 2000). Researches have been emphasized the importance of asymmetry between the limbs. Increased postural sway and strength asymmetries of lower extremity have been reported as risk factors for falls in elderly population (Rogers et al., 2003; Cheng et al., 2001). Also, asymmetry between the limbs was also reported during walking and running (Herzog et al., 1989; Sadeghi et al., 1997).
However, it has been unknown the effects of long-term leisure participation on balance measure and lower extremity asymmetries. The aim in this study was to investigate the effect of leisure sports participation on balance measures such as double and single leg standing and asymmetry of lower extremities.

Table 1

Characteristics of subject in the non-involved, mid and long term Groups.

Group		Age(year)	Height(cm)	Weight(kg)	Mean term* (year)
Non involved	M 12, F 18	47.93±6.16	163.17±8.48	62.54±9.14	
Mid term	M 6, F 21	54.37±5.46	155.61±31.22	60.94±15.64	3.62±2.54
Long term	M 17, F 6	51.91±6.81	166.17±9.67	70.10±12.52	17.70±8.43

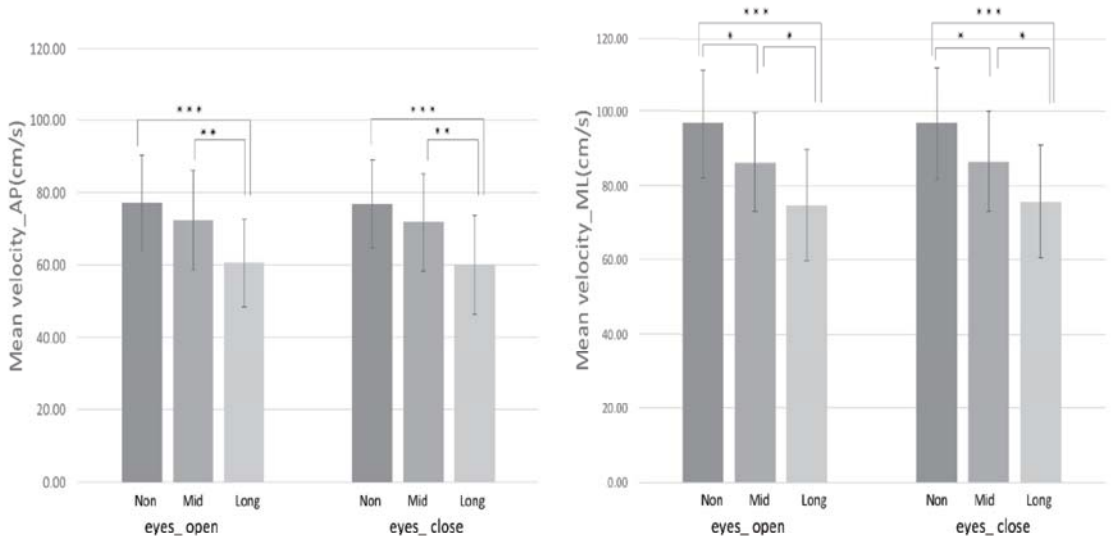
* Exercise participation period values given as mean ± standard deviation(SD)

METHODS: Eighty participants were participated in the study. Leisure sports for participation period were self-reported and participants divided into three groups: non-involved, mid-term, long term (Table 1). Subjects have not any musculoskeletal disorder in the last 6 months. COP data were recorded by one force plate (AMTI MSA-6, AMTI, USA) at 2000 Hz sampling rate. Subjects were instructed to perform single leg and double leg standing for 30 and 60 seconds, respectively. COP related variables were selected for both double and single leg standing as center of pressure anterior posterior (COP_AP) and medial lateral (COP_ML) displacement, center of pressure mean velocity (COP_MV), center of pressure area (COP_Area). Also the symmetry index (SI) was calculated for every COP variable to assess the asymmetry between dominant and non-dominant legs (Robinson,Herzog & Nigg, 1987):

$$SI = \frac{|X_D\text{-}X_N|}{1/2(X_D + X_N)} \times 100\%$$

Where X_D and X_N are each variable values of the dominant and non-dominant legs. SPSS 18.0 statistics program was used for descriptive analysis. One-Way ANOVA used for the differences according to the sport participation groups. Scheffe post-hoc test were used if there is significant difference. The significance level was set at .05.

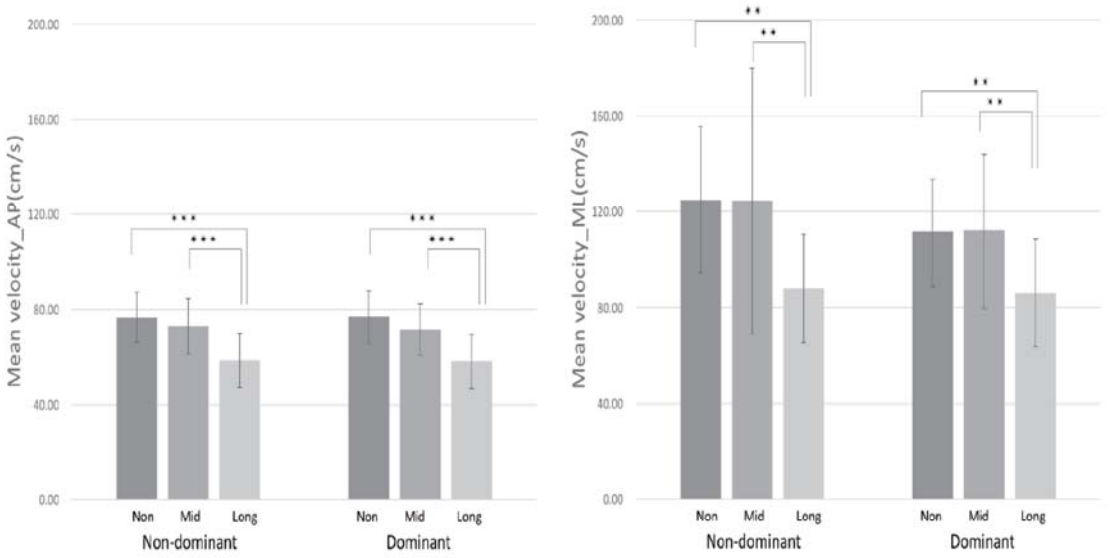
RESULTS: There was no significant difference for COP_AP COP_ML, and COP_Area during double leg (eyes open and closed) and single leg. COP_MV_AP (F=10.907, p<.001) and COP_MV_ML (F=15.509, p<.001) showed a statistically significant difference during eyes open double leg standing. COP_MV_AP (F=10.861, p<.001) and the COP_MV_ML (F=13.706, p<.001) showed a statistically significant difference during closed eye double leg standing. Post-hoc test results showed below at Figure 1.



Non: non-involved, Mid: mid term, Long: long term, *: <.05, **:<.01, ***:<.001

Figure 1: Double leg standing mean velocity results.

COP_MV_AP showed statistical differences for dominant and non-dominant (F=19.108, p<.001; F=18.339, p<.001) single leg standing. COP_MV_ML also showed significant difference for dominant and non-dominant (F=7.906, p=.001; F=7.259, p=.001) single leg standing. Post-hoc test results showed below at Figure 2. There was no statistical difference for SI between the dominant and non-dominant leg during single leg standing tests.



Non: non-involved, Mid: mid term, Long: long term, *: <.05, **:<.01, ***:<.001

Figure 2: Single leg standing mean velocity of center of pressure.

DISCUSSION: COP measures and symmetry between the dominant and the non-dominant leg investigated in this study to explain the effects of the participation to leisure sports. The studies mostly investigate the effects of 8 to 16 weeks training on balance to measure (Miller et al., 2006; Messier et al., 2000), however we have limited knowledge of long term sport participation on balance and lower extremity symmetry.

There were statistical differences between the groups for COP_MV at each standing tasks (double and single leg), even though, there was no statistical differences for COP_AP COP_ML, and COP_Area. It has been reported that COP_MV is an important indicator of better stability (Pinsault & Vuillerme, 2009; Winter et al., 2003; Lin et al., 2008) and increased COP_MV considered as a risk of elderly populations (Rogers et al., 2003), Therefore, long term sports participations may be helpful to improve the postural control and prevent the fallings. There was also differences according to the participation term which can be concluded as the longer participation can be helpful to achieve better stability for middle-aged adults.

Asymmetry occurs as a result of injury, inappropriate movement patterns, excessive training (Sadeghi et al., 2000; Chung & Choi, 2009; Gossman et al., 1982). However, our subjects have been participated in leisure sports 1.96 ± 2.27day in a week which is insufficient to expose them the factors that mentioned above.

Gender and sport effects didn't evaluate in this study. Further studies should be made in order to understand the effect of gender and different kind of sports on balance measures.

CONCLUSION: Increasing the sports participation period significantly reduced the COP_MV which is an important indicator for the stability and postural control. It can be helpful to prevent falls during the aging process. Gender factors and variety of sports should be investigated in the future to clarify the effect of long term sports participation.

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