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The Effect of 7-Weeks of Yoga Training on Flexibility, Balance, Upper Extremities Strength, Lower Limbs Power on Middle-Aged Health Women

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Abstract: The study set out to investigate how a yoga interventional training program affected the flexibility, grip strength, lower limb strength, and balance of yoga practitioners. 22 women, with ages of 36.09 ± 12.72 years, body weight of 60.27 ± 11.18 kg, and height of 166.00 ± 5.96 cm, participated in the study. Two groups of participants were formed: the experimental (EG) group and the control group (CG). Women who did not participate in any sports made up the CG, whereas participants in a particular yoga exercise program made up the EG. Over the course of seven weeks, the experimental group's participants completed two 60-minute exercises every week, for a total of 14 sessions spaced 72 hours apart. The baseline measurement was completed by the participants one day before to the commencement of the intervention program, to assess their starting performance level in the parameters under examination. The following tests were administered to all individuals following a brief warm-up that comprised a brisk run and mild stretching exercises: i) sit and reach test; ii) squat leap; iii) grip strength; and iv) Balance Error Scoring System (BESS). The participants were assessed using the identical tests used for the baseline measurement one day following the conclusion of the intervention program. Findings indicated a marginal improvement in lower extremity strength together with a statistically significant improvement in the EG's assessment of flexibility and balance. The left hand shown a statistically significant gain in grip strength, while the right hand exhibited a non-significant improvement. On the other hand, the CG displayed a decline in efficiency across all metrics. The study's findings support the notion that women who practise yoga might benefit from increased flexibility, strength in their lower limbs, grip strength, and balance.

Keywords: Pranayam, Savasana, Yoga, flexibility, strength, balance, health population

Introduction

Yoga is an age-old discipline that uses postures (asanas), breathing exercises (pranayama), and meditation (dhyana) to target the physical body and promote mental and physical well-being [Amin & Goodman, 2014]. [Schmid, Miller, DeBaun-Sprague, Van Puymbroeck, 2014]. One of the earliest forms of physical and mental relaxation therapy is yoga [Nayek Chatterjee, 2016]. It is also an exercise that may concurrently improve a number of different fitness-related aspects, even for athletes from a variety of sports [Ajayagosh & Mahadevan, 2018; Kartal Ergin, 2020; Raj, Sudheer, 2018; Singh, Singh & Gaurav, 2011].This method's primary feature is the gradual maintaining of bodily postures for a predetermined amount of time while transitioning fluidly between postures. The idea behind yoga is different from other traditional forms of training since it involves several positions that the body may take on. [Sharma and Gulati, 2011] All practitioners, athletes or not, may improve the body's functioning by reducing movement limitations and maximising movement affordances with the right instruction.The physical practice of yoga involves holding a sequence of Asanas (static postures) that use all of the participating muscle groups while adjusting the body's alignment with regular, steady breathing. According to McArdle and colleagues, practicing yoga for an extended length of time can enhance a number of particular fitness metrics, including increased muscle fibre recruitment and range of motion (ROM). [Katch, Ardle, & Katch, 2014]. The results of studies show that female participants aged 40–65 who participated in a 6-week yoga intervention program significantly improved in terms of flexibility [Amin & Goodman, 2014], as did students who participated in a 12-week intervention program [Hovsepian, Marandi, Kelishadi, & Zahed, 2013], and football players who participated in a 10-week intervention program [Polsgrove, Lockyer, & Eggleston, 2016]. In their evaluation of the impact of a 12-week yoga and physical exercise program on the lower extremity's explosive power and agility in students ages 14 to 16, Malipatil and Patil (2016) found that the physical activity group outperformed the yoga group in terms of agility and leaping ability. Additionally, an 8-week yoga intervention programme that included pranayama and asana movements enhanced the individuals' lower limb strength and endurance (Van Puymbroeck et al., 2007). After 12 weeks, Telles and colleagues' [2009] study on the impact of a yoga programme on professional computer users discovered a considerable increase in grip strength, whereas the control group showed no discernible improvement.

According to Prado and colleagues' [2014] research, Hatha Yoga enhances body balance in adults who have completed a 5-month yoga training program that includes postures, breathing exercises, relaxation techniques, meditation, and methods for contracting and relaxing muscles and organs.In a 2013 study, Tiedmann and colleagues looked at how a 12-week Iyengar Yoga program affected the balance and mobility of senior citizens who did not take part in Tai Chi or yoga programs. The outcomes demonstrated how Iyengar Yoga improved the older subjects' balance and mobility. Polsgrove et al.'s [2016] study on the benefits of yoga for balance involved 10 weeks of yoga practice among collegiate athletes, and the results showed that yoga improved balance. In a 12-week intervention program that included breathing exercises (pranayama) and 15 to 20 various yoga postures, Hovsepian and colleagues (2013) investigated the effects of yoga and aerobics on female physical education students and discovered a substantial increase in balance.Additionally, Donahoe-Fillmore et al.'s study from 2010 looked at how a 7-week yoga program affected the students' strength, flexibility, and balance. Of the variables they tested, only ROM showed statistically significant improvement. Considering the aforementioned, there appears to be a deficiency in the research on the impact of yoga on middle-aged women. To the best of our knowledge, this is the first study to look at how yoga training affects flexibility, balance, strength in the upper extremities, and power in the lower limbs on the same sample. Thus, the aim of the research was to investigate how middle-aged healthy women's flexibility, balance, upper extremity strength, and lower limb power were affected by a seven-week yoga program.

Hypothesis

We hypothesized that the regular practice of yoga positioning training for 7 weeks in middle-aged women would improve the measures of flexibility, strength, and static balance.

Methods

In this 7-week preliminary study, twenty-two women with a mean age 36.09 ± 12.72 years, body mass 60.27 ± 11.18 kg, and body height 166.00 ± 5.96 cm who had been engaged for 13.75 ± 11.98 months were participated. Participants were divided into Yoga group (YG) that involved in Yoga sessions and participants of the nonyoga group (control group) (NYG) were not involved in any sporting activities except in the daily housework. In addition, participants of the YG were informed that at any stage of the intervention program they can be withdrawn if they so wished. Somatometric characteristics of participants are presented in table 1. No significant differences were found on age and body height except body height ($p > .05$).

Table 1: Somatometic characteristics of participants

	YG (n=10)	NYG (n=10)
Age (years)	34.91 ± 13.00	37.66 ± 12.94
Body mass (kg)	55.73 ± 4.78	66.33 ± 14.45 *
Body height (cm)	164.00 ± 5.49	168.66 ± 5.58

* $p < .05$

A Chrono Jump platform was utilised to measure the lower extremities' explosive power; a unique tool called a Cranlea, UK, instrument was used to measure the flexibility of the lower back and knee flexor flexors using the sit test and reach; a Jamar Hydraulic Hand Dynamometer was used to measure grip strength; and the Balance Error Scoring System (BESS) was used to measure static equilibrium.

Experimental Procedure

Every measurement was taken at the PLANET FITNESS AND MORE fitness centre. Following written explanations of the study's objectives and experimental methodology, the volunteers had their body weight (in kilogrammes) and height (in centimetres) measured, and their birth year was noted. The participants were familiar with both the intervention program's activities and the exercises that would be evaluated two weeks prior to the start of the trial, which was necessary to ensure proper execution of the exercises and the validity of the measures.

Over the course of seven weeks, the participants completed two 60-minute sessions per week, spaced 72 hours apart, for a total of 14 exercises. The intervention programme comprised upright postures, including a Vinyasa to help participants transition to the opposite side, warm-up exercises, Surya Namaskar A (Sun Salutation A), and pranayama (breathing techniques and methods energy distribution in the body). Vinyasa is a set of postures that include Chaturanga Dandasana (vertical support with elbows bent towards the ribs), Urdhva Mukha Svanasana (upright dog), and Adho Mukha Svanasana (downward dog), without holding any particular poses for longer than necessary.After that, the class covered balancing, supporting, sitting, and supine poses. Every session concluded with the practice of Savasana, also known as the corpse pose. This relaxation pose is

done while lying down on one's back with the legs spread wide, hands resting next to the body with the palms facing down, eyes closed, and the body totally at ease.The participants completed the first measurement to assess their starting performance level in the parameters under examination one day prior to the commencement of the intervention programme. The following tests were administered to all participants right after their brief warm-up, which included easy running and low-intensity stretching exercises: a) flexibility of the knee and lower back flexor muscles; b) lower limb explosive strength; and c) static balance. In order to counteract the tiredness aspect, there was a 2-minute pause in between individual measurements and a 30-second break between attempts. Prior to the start of the experimental procedure, all participants were assessed a) for flexibility of the lumbar and knee flexor muscles by performing the sit & reach test (S & R); b) explosive strength of lower limbs by performing the squat jump (SJ); c) grip strength; and d) static balance by Balance Error Scoring System (BESS). In all tests, except for the BESS, the participants were performed two attempts, including a 30-second break. The best effort of the two was used for further statistical processing.

Statistical Analysis

Statistical analyses were performed using SPSS version 24 (IBM, New York, USA). A two-way (group x time) ANOVA with repeated measures on the second factor was used for the statistical analysis. Sphericity was checked using Mauchly's test, and the Greenhouse-Geisser's correction on degrees of freedom was applied when necessary. Levene's test of equality of error variances was used to check the assumption of homogeneity of variances. In cases where interaction between time and group was detected, the simple effects were investigated, and Bonferonni's correction was used. In the absence of interaction, the main effects of the two factors (time and group) on the dependent variables were investigated. All statistical significances were tested at $\alpha = 0.05$.

Results

The statistical analyses revealed that the interaction effect between time and group was statistically insignificant for S & R ($F_{(1)} = 4.091$, $p > 0.060$, $\eta^2 = .204$). No main effect was found for time ($F_{(1)} = 2.282$, $p < 0.150$, $\eta^2 = 0.125$).Regarding SJ, no significant interaction effect between the two factors ($F_{(1)} = 2.988$, $p > 0.103$, $\eta^2 = .157$) and also no significant main effect for time ($F_{(1)} = 1.676$, $p > 0.214$, $\eta^2 = .095$).The power of the SJ results indicated a non-significant interaction effect between the two factors ($F_{(1)} = 4.009$, $p < 0.063$, $\eta^2 = 0.200$). However, significant main effect was found for time ($F_{(1)} = 12.744$, $p < 0.003$, $\eta^2 = 0.443$). The post hoc analysis showed that power significantly increased after 7-weeks Yoga training ($t = -10.069$, $p = .001$) for EG. The mean values of the examined variables are presented in table 2.

		Pre	Post
S & R (cm)	YG	30.40 ± 10.25	33.85 ± 7.60 *
	NYG	29.56 ± 4.89	29.06 ± 6.57
SJ height (cm)	YG	14.518 ± 3.52	14.676 ± 4.51
	NYG	15.065 ± 4.17	13.965 ± 4.97
SJ power (N)	YG	457.38 ± 51.14	740.30± 117.91 *
	NVG	524.76 ± 114.74	604.36 ± 249.84

*p< .05

Significant interaction effect was found for left handgrip $F_{(1)} = 7.461$, $p < 0.015$, $\eta^2 = 0.318$). However, no main effect was found for time ($F_{(1)} = 0.451$, $p < 0.512$, $\eta^2 = 0.027$). Further, there was no significant interaction effect for right handgrip ($F_{(1)} = 3.373$, $p < 0.085$, $\eta^2 = 0.174$) and no main effect for time ($F_{(1)} = 0.721$, $p < 0.408$, $\eta^2 = 0.043$). Regarding BESS results showed significant interaction effect between time and group ($F_{(1)} = 18.868$, $p < 0.001$, $\eta^2 = 0.541$) and significant main effect for time ($F_{(1)} = 6.792$ $p < 0.019$, $\eta^2 = 0.298$). The post hoc analysis showed that BESS significantly increased after 7-weeks Yoga training ($t = 4.151$, $p = .002$) for EG. The mean values of the examined variables are presented in table 3.The percentage differentiation on the examined variables is presented in figure 1.

		Pre	Post
Handgrip Right (Nt)	YG	24.10 ± 4.64	25.86 ± 4.43
	NVG	30.37 ± 5.28	29.75 ± 5.28
Handgrip Left (Nt)	YG	23.50 ± 3.68	24.90 ± 3.93 *
	NYG	30.00 ± 3.54	27.68 ± 6.46
BESS (number of errors)	YG	17.40 ± 7.47	11.40 ± 5.25*
	NVG	20.62 ± 6.11	22.12 ± 5.74

*p< .05

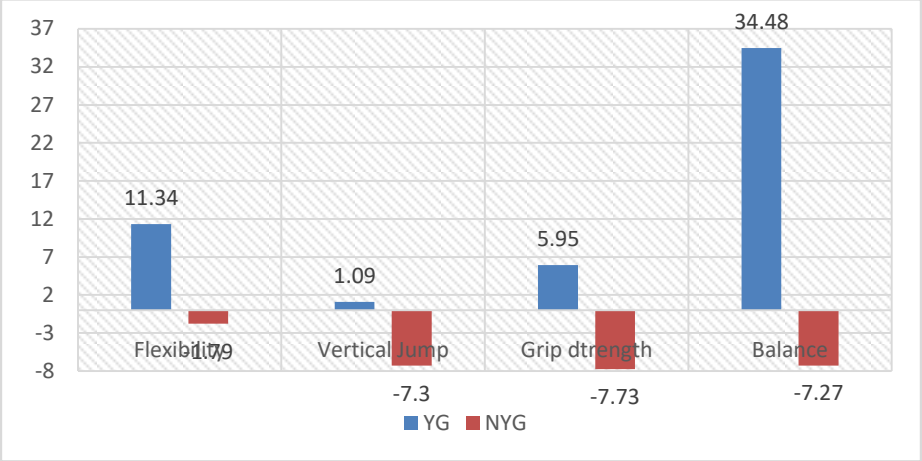

Figure 1: Percentage differentiation on groups on various variables

Discussion

This study set out to investigate how a 7-week yoga programme affected several fitness components in middle-aged, healthy women. There were no discernible variations in SJ height or right handgrip. The particular yoga poses used during yoga sessions may be responsible for statistically significant gains in flexibility and static balance. More precisely, the total results demonstrated that the YG demonstrated an improvement in the evaluation of flexibility that was statistically significant by 11.34%; this conclusion is supported by the findings of other studies [Amin& Goodman, 2014;Polsgrove, Eggleston, Lockyer, 2016; Van Puymbroeck, Payne,& Hsieh, 2007; Bal &Kaur, 2009; Telles, Dash & Naveen, 2009].On the other hand, following the conclusion of the intervention program, NYG indicated a little decline (1.79%). Nevertheless, the previously stated research employed distinct methods with regards to the length and frequency of training sessions, as well as distinct samples. Furthermore, the findings indicate that whereas the NYG had a substantial decline following the conclusion of the intervention program, the YG demonstrated a tendency towards 1.09% improvement in lower limb strength. Given that evidence indicates middle-aged people require around 10 weeks of strength training to enhance strength, the lack of statistically significant progress may be related to the yoga programs 7-week length. [Kalapotharakos, Smilios, Tokmakidis, 2007]. Our study's findings are consistent with earlier research [Malipatil, & Patil, 2016], which assessed how yoga workouts affected the foot's explosive power and came to the conclusion that practicing yoga poses slowly increased strength and muscular flexibility. Furthermore, support evidence from Van Puymbroeck et al. [2007] showing Hatha Yoga increases foot strength in atypical carers and Kim et al. (2012) supporting the idea that an 8-month-old yoga intervention improves leg muscle strength in normal premenopausal women. Moreover, they are consistent with research by Schmid et al. [2014] showing that an 8-week yoga intervention program enhanced a person with a chronic stroke's lower extremity strength.

The YG shown a notable improvement in balancing ability, with a 34.48% decrease in the overall number of mistakes, whereas the NYG had a modest rise of 7.27%. According to earlier research, the balance ability improvement observed in this study is consistent with findings from other studies [Hovsepian, Marandi, Kelishad, & Zahed, 2013; Polsgrove, Eggleston, Lockyer, 2016; Prado, Raso, Scharlach & Kasse, 2014; Tiedemann, O'Rourke, Sesto & Sherrington, 2013]. Furthermore, our findings align with those of Ulger and Yagl [2011], who demonstrated the beneficial effects of balancing on women with musculoskeletal problems.It should be mentioned that enhancing balance can aid in lowering senior fall rates, which are a significant source of unpleasant events. [Schmid, Koceja, & Van Puymbroeck, 2010]. All forms of yoga that use different breathing methods (pranayama) and meditation (dhyana) to enhance body coordination, strength, flexibility, balance, and development of asanas (postures). [Kraftsow (1999)] In general, yoga improves haemoglobin and red blood cell levels, blood flow, and the amount of oxygen that reaches bodily cells, improving their functionality. [Call, 2007].

Ultimately, there was a 5.95% statistically significant improvement in the left handgrip but not in the right. There was a relative improvement of 7.30%, which suggests that the right hand was dominant and that there was little chance for a large improvement. This outcome is consistent with research by Dash and Telles [2001], who looked at rheumatoid arthritis patients, healthy adults, and children and discovered a substantial increase in grip strength following a yoga intervention. Conversely, in the aforementioned investigations, NYG shown a modest decrease in handgrip on both hands or no improvement at all.Nevertheless, our study had a number of limitations, thus it is not possible to generalize the findings. The sample consists of many middle-

aged women who have attended yoga classes at various times. The various yoga poses were not recorded for each session, and the poses that were selected focused on the health and well-being of the entire body rather than just strengthening or stabilizing certain muscle groups. Longer training sessions, posture records from each session, and the selection of postures that match the variables to be studied—including a bigger sample size—must be done in future research.

Conclusions

Our results indicate that after 14 Yoga sessions, the YG's flexibility, left handgrip strength, and balance all exhibited statistically significant improvements. As a result, by boosting particular fitness components, yoga may help healthy middle-aged women perform better. To assess the impact of yoga on various age groups, genders, and fitness components, further research needs be conducted.

Conflict of Interests:
The authors declared no conflict of interests regarding the publication of this manuscript.

References

[1]. Amin, D. J., &Goodman, M. (2014). The effects of selected asanas in Iyengar yoga on flexibility: Pilot study. *Journal of Bodywork and Movement Therapies*, 18, 399-404.
[2]. Schmid, A. A., Miller, K. K., Van Puymbroeck M, DeBaun-Sprague E. (2014).Yoga leads to multiple physical improvements after stroke, a pilot study. *Complementary Therapies in Medicine*, 22, 994-1000.
[3]. Nayek, B., Chatterjee, K. (2016). Effects of 6 Weeks Yoga and Aerobic Exercise on Muscular Strength and Flexibility of Pre-Adolescence Students. *International Journal of Yogic, Human Movement and Sport Science*, 1, 12-6.
[4]. Ajayagosh, M. V., Mahadevan, V. (2018). Effect of Functional Strength Training and Vinyasa Flow Yoga on Selected Physical Variables among Men Soccer Players. *International Journal of Physiology, Nutrition and Physical Education*, 3,378-81.
[5]. Kartal, A., Ergin, E. (2020). Investigation of the effect of 6-week Yoga exercises on balance, flexibility, and strength in soccer players. *International Journal of Human Movement and Sports Science*, 8, 91-6.
[6]. Raj, T.S., Sudheer, G. (2018). Effect of Specific Yoga and Aerobic Exercises on Selected Motor Abilities Among Cricket Players. *International Journal of Yoga, Physiotheraphy and Physical Education*, 3, 57-60.
[7]. Singh, A., Singh, S., Gaurav, V. (2011). Effects of 6 Weeks Yogasanas Training on Agility and Muscular Strength in Sportsmen. *International Journal of Educational Reearch and Technology*, 2, 72-74.
[8]. Gulati, R., Sharma, A. (2011). Physical and mental fitness in sports person-role of yoga-fitness prescribe in ancient books. *Physical Education in Sport Science and Movement Health*, 1, 120–5.
[9]. McArdle, W., Katch, F., Katch, V. (2014).*Exercise physiology: Nutrition, energy, and human performance*. 8th ed. Philadelphia: Lippincott Williams and Wilkins, pp. 337–76.
[10]. Hovsepian, V., Marandi, S. M., Kelishadi, R., Zahed, A. (2013). A comparison between yoga and aerobic training effects on pulmonary function tests and physical fitness parameters. *Pakistanian Journal of Medical Science*, 29, 317-20.
[11]. Polsgrove, M. J., Eggleston, B. M., Lockyer, R. J. (2016). Impact of 10-weeks of yoga practice on flexibility and balance of college athletes. *International Journalof Yoga*, 9 (1), 27-34.
[12]. Malipatil, R. P., Patil, S. S. (2016). The effect of Yoga and physical exercise on leg explosive strength and agility variables of secondary school students. *European Journal of Physical Education and Sport Science*, 2, 177-84.
[13]. Van Puymbroeck, M., Payne, L. L., Hsieh, P. C. (2007). A phase I feasibility study of yoga on the physical health and coping of informal caregivers. *Evidence-Based Complementary and Alternative Medicine*,4, 519-259.
[14]. Telles, S., Naveen, V. K., Balkrishna, A., & Kumar, S. (2009). Short term health impact of a yoga and diet change program on obesity. *Medical Science Monitor*, 16, 35-40.
[15]. Prado, E. T., Raso, V., Scharlach, R. C., Kasse, C. A. Hatha yoga on body balance. *International Journal of Yoga*, 7, 133-137.
[16]. Tiedemann, A., O'Rourke, S., Sesto, R., Sherrington, C. (2013). A 12-week Iyengar yoga program improved balance and mobility in older community-dwelling people: a pilot randomized controlled trial. *Journal of Gerontology: Biological Sciencein Medicine and Science*, 68, 1068-1075.
[17]. Donahoe-Fillmore, B., Brahler, C., Fisher, M. I., Beasly, K. (2010).The Effect of Yoga Postures on Balance, Flexibility, and Strength in Healthy High School Females. *Journal of Women's and Public Health Physical Therapy*,34, 10–17.

[18]. Bal, B. S., Kaur, P. J. (2009). Effects of selected asanas in hatha yoga on agility and flexibility level. *Journal of Sport and Health Research,* 1, 75-87.
[19]. Lau, C., Yu, R., Woo, J. (2015). Effects of a 12-week hatha yoga intervention on cardiorespiratory endurance, muscular strength and endurance, and flexibility in Hong Kong Chinese adults: a controlled clinical trial. *Evidence-based Complementary and Alternative Medicine,*2015:958727. doi: 10.1155/2015/958727.
[20]. Telles, S., Dash, M., Naveen, K. V. (2009).Effect of yoga on musculoskeletal discomfort and motor functions in professional computer users. *Work*, 33, 297-306.
[21]. Kalapotharakos, V., Smilios, I., Tokmakidis, S. (2007). The effect of moderate resistance strength training and detraining on muscle strength and power in older men. *Journal of Geriatric Physical Therapy,* 30, 109-113.
[22]. Ülger, Ö., Yağlı, N. V. (2011). Effects of yoga on balance and gait properties in women with musculoskeletal problems: a pilot study. *Complementary Therapies in Clinical Practice*, 17, 13-15.
[23]. Schmid, A. A., Van Puymbroeck, M., Koceja, D. M. (2010). Effect of a 12-week yoga intervention on fear of falling and balance in older adults: a pilot study. *Archives of Physical Medicine and Rehabilitation*, 91, 576-583.
[24]. Kraftsow, G. (1999). Yoga for wellness: Healing with the Timeless Teachings of Viniyoga. Penguin.
[25]. McCall, T. (2007). *Yoga as Medicine*. New York, NY, USA: Bantam Dell a Division of Random House.
[26]. Dash, M., Telles, S. (2001). Improvement in hand grip strength in normal volunteers and rheumatoid arthritis patients following yoga training. *Indian Journal of Physiology and Pharmacology,* 45, 355-360.

Table 1: Somatometic characteristics of participants

	YG (n=10)	NYG (n=10)
Age (years)	34.91 ± 13.00	37.66 ± 12.94
Body mass (kg)	55.73 ± 4.78	66.33 ± 14.45 *
Body height (cm)	164.00 ± 5.49	168.66 ± 5.58

* p < .05

Table II. Descriptive statistics (means ± SD) on S & R and Squat jump (SJ) performance

		Pre	Post
S & R (cm)	YG	30.40 ± 10.25	33.85 ± 7.60 *
	NYG	29.56 ± 4.89	29.06 ± 6.57
SJ height (cm)	YG	14.518 ± 3.52	14.676 ± 4.51
	NYG	15.065 ± 4.17	13.965 ± 4.97
SJ power (N)	YG	457.38 ± 51.14	740.30± 117.91 *
	NYG	524.76 ± 114.74	604.36 ± 249.84

*p< .05

Table III. Descriptive statistics on handgrip strength and Balance assessment (means ±SD)

		Pre	Post
Handgrip Right (Nt)	YG	24.10 ± 4.64	25.86 ± 4.43
	NYG	30.37 ± 5.28	29.75 ± 5.28
Handgrip Left (Nt)	YG	23.50 ± 3.68	24.90 ± 3.93 *
	NYG	30.00 ± 3.54	27.68 ± 6.46
BESS (number of errors)	YG	17.40 ± 7.47	11.40 ± 5.25*
	NYG	20.62 ± 6.11	22.12 ± 5.74

*p< .05

Figure 1: Percentage differentiation on groups on various variables