Influence of a Five-Week Exercise Program On Posture, Physical Fitness and Group Cohesion in University Female Employees

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ABSTRACT

The purpose of this study was to examine the effects of a five-week exercise program on posture, physical fitness, and group cohesion in university female employees. Seven females (age: 43.3±11.3 yrs; height: 163.9±2.4 cm; mass: 59.3±11.2 kg) completed the postural and physical fitness assessment before and after the program; which included a postural screening, side bridge endurance, trunk flexor endurance, shoulder and wrist elevation, trunk and neck extension, sit-and-reach, straight leg raise, and overhead squat. Twelve females (age: 48.7±12.3 yrs; height: 163.3±5.1 cm; mass: 65.5±11.9 kg) completed the Physical Activity Group Environment Questionnaire (PAGEQ) after the program and the mean of each subscale was calculated. The class consisted of strengthening and flexibility exercises for the core, posture, and upper and lower body. Dependent t-tests revealed significant improvements in the sit-and-reach (pre: 27.5±7.9 cm and post: 58.3±11.2, $p = .04$), right (pre: 26.1±18.5 s and post: 38.7±12.0 s, $p = 0.04$) and left side bridge endurance test (pre: 21.9±8.9 s and post: 36.0±15.6 s, $p = 0.01$), trunk flexor endurance (pre: 29.9±14.0 s and post: 43.3±16.2 s, $p = 0.02$) and the right (pre: 76.3±10.5° and post: 86.7±9.6°, $p = 0.02$) and left straight leg raise (pre: 71.9±8.8° and post: 84.6±13.3°, $p = 0.03$). There were no significant improvements in the other physical fitness assessments ($p > 0.05$). The PAGEQ subscales suggest subjects were attracted to the group because of the task. The program improved lower body flexibility and core muscular endurance, but did not significantly improve posture.

KEYWORDS: Health promotion; workplace; PAGEQ

Posture is the way a person moves, sits, and walks and is individually unique. It is also defined as the spine being in a neutral position, with good posture being imperative for improved health (Price 2010). Posture is an important function because it is involved in movements of daily life, such as standing, sitting, bending, and lying. Postural reflexes help us maintain body position, which requires continuous sensory input from visual and vestibular sensory systems. Maintenance of posture involves muscles to contract, which enables the body to remain in both seated and standing positions. However, prolonged sitting or standing can have a detrimental effect on an individual's posture and lead to many postural abnormalities (Harmen et al. 2005).

Workers that sit in certain positions for long periods of time are at a higher risk for neck, shoulder, and back pain (Roddey et al. 2002). Lack of proper postural placement can be detrimental to muscle function and create an unpleasing feeling (Roddey et al. 2002). Poor postural adaptations along with muscle imbalances have been shown to lower the functional quality of life (Harman et al. 2005); particularly for workers with poor sitting posture at a desk or office chair for several hours every day (Falla et al. 2007). Since about 75% of jobs today require individuals to sit behind a desk for extended periods of time, posture is bound to worsen by the end of the day due to habitual practice, chair design, or fatigue of postural muscles (Harman et al. 2005; Van Dieen et al. 2001; Vos et al. 2006).

The cumulative effect of the time spent in certain positions can lead to prolonged static-posture damage to both the musculoskeletal and myofascial systems of the body (Price 2010). Many postural abnormalities occur frequently in those whose job requires them to stay in a static standing or seated position for long periods of time. This poor postural position

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over time can lead to structural changes in the shape of the cervical region, spine, or shoulders (Riegerová et. al 2008). Common abnormalities include Forward Head Posture (FHP), Forward Head Rounded Shoulder Posture (FHRSP), Forward Shoulder Posture (FSP), or thoracic kyphosis.

Research has suggested that FHP was associated with pain or fatigue in the neck and shoulder region due to the misalignment of the head on the trunk (Harman et al. 2005; Thigpen et al. 2010). Harman et al. (2005) found FHP was caused by a weakness in the scapular retractors (rhomboids, serratus anterior, and middle and lower trapezius) and shortening or tightening of the cervical extensors or the pectoralis muscles. Elongation of the scapular retractors and shortening of the pectoral muscles has also been associated with FHRSP (Roddey et al. 2002). Thus, muscle imbalances related to the upper and lower back can result in postural deformities. Thoracic kyphosis causes a bowing or rounding of the thoracic spine and has been related to pathological or biomechanical factors (Ashton-Miller 2004; Lewis and Valentine 2010).

Various types of exercise programs have been designed to correct postural deformities and diminish pain that results from poor posture. Exercise programs such as Pilates (De Fonseca et al. 2009), stretching (Kluemper et al. 2006; Roddey et al. 2002), and strength training (Barrett 2010; Falla et al. 2007) have shown to improve posture and reduce pain. In addition, Leavey et al. (2010) found that using proprioceptive exercises significantly improved one's strength and posture. Fox et al. (2008) found that fatiguing anaerobic and aerobic exercise protocols adversely affected healthy collegiate athletes' postural control. Finally, a targeted-exercise program to the pelvic region showed an improvement in stance stability and shoulder and hip (Riegerova et al. 2008). Previous research has illustrated the positive effects of strengthening and stretching exercises used to improve the quality of life and posture of individuals exhibiting postural deviations (Barrett 2010; De Fonseca et al. 2009; Falla et al. 2007; Kluemper et al. 2006; Leavey et al. 2010; Roddey et al. 2002). Understanding the different effects of exercises with the help of modern technology makes it possible to design programs on postural stability that focus on elderly, athletes, and other populations (Zemková 2009).

Research has not only investigated the impact of exercise on posture, but also the psychological effect exercise has on individuals who engage in it for the social or task aspect of group exercise. Korkmaz (2010) reported that a 12-week Pilates class had a positive effect on the social physical concern score after completing the exercise class. Cotter and Sherman (2008) found that older adults, who had more social support, reported higher self-efficacy scores in group exercise classes. Another study examined clinical prevention and rehabilitation exercise programs to determine the role social support and group cohesion had on adherence rates. This study found that when individuals felt the exercise class catered to the task and not the social aspect, they were more likely to attend a higher proportion of classes (Fraser & Spink, 2002). Lastly, the behavior of the group fitness leader plays an important role in the psychological aspect of the exercise. Loughead et al. (2008) reported that cohesion was a mechanism through which the leader's behavior influenced an exerciser to be more concerned with the task aspect of the class than the social aspect of the exercise session.

Previous research has demonstrated the existence of postural deformities and the pathology leading to the adoption of poor postural habits. Furthermore, it also indicates that exercise programs with positive attitudes toward group cohesion assisted the participant by drawing interest to their desire to succeed at the task. Thus, the primary purpose of this study was to examine the effects of a five-week exercise program on posture and components of physical fitness in university female employees. The secondary purpose was to analyze group cohesion and to determine if females were interested in the task aspect or the social aspect of the exercise program.

METHODS

Subjects

Potential subjects were recruited for the five-week exrcise class via an email that was sent to all staff, faculty, and administrators at Shippensburg University. A total of 13 female employees signed up to participate in the exercise program. Fifty percent (7 females; age: 43.3±11.3 yrs; height: 163.9±2.4 cm; mass: 59.3±11.2 kg) volunteered for the postural and physical fitness assessment before and after the five-week program. They also signed an informed consent document and were assessed using a health history questionnaire and the Physical Activity Readiness Questionnaire. All subjects were primarily at their desk for the entire workday. The Physical Activity Group Environment Questionnaire (PAGEQ) (Lox et al. 2006) was complete by 12 of the 13 females, who registered for the class, at the end of the five weeks (Table 1). The Committee on Research on Human Subjects at Shippensburg University approved the study.

Table 1. Descriptive characteristics of subjects (N = 12 females.

Variable	M±SD
Age (years)	46.0±11.8
Weight (kg)	62.4±11.6
Body Fat (%)	28.0±7.5
Height (cm)	163.6±3.8

Postural and Physical Fitness Assessments

Height, weight, and percent body fat were measured at the beginning of the study. Body composition was estimated using a hand-held bioelectrical impedance analyzer (Omron, Model HBF-306) and standard guidelines were followed.

Posture was assessed using the Posture Evaluation Form (Fahey et al. 2009) and a baseline posture grid (Fabrication Enterprises, White Plains, NY). Subjects were asked to remove their shoes prior to the postural assessment. Head, shoulder, spine, hip, and foot alignment were all assessed from the anterior, posterior, and lateral views. The subject's posture was assessed using a Likert scale of 1, 3, and 5; 5 being the best score and 1 being the worst.

Muscular endurance was assessed with the side bridge endurance test and the trunk flexor endurance test (Fahey et al. 2009). The side bridge endurance test was performed on both sides of the body in which the legs were extended and one foot was placed in front of the other on a mat. The subject lifted their hips off of the mat and used the support of their elbow to hold the position as long as possible. A stopwatch was used to determine the amount of time that the subject could hold herself up. Once they dropped to the floor or used their hand for support the time was stopped (Fahey et al. 2009). For the trunk flexor endurance test, the subject assumed a sit-up position with the researcher's hand placed on the back for support at a 60° angle and the legs flexed at 90° with arms folded across the chest. The researcher removed the hand from the participant's back and this static position was held for as long as possible while a stopwatch recorded the time. The test was ended when the subject could not maintain the static position any longer (Fahey et al 2009).

Flexibility was measured using the active straight leg raise, the shoulder and wrist elevation test, the trunk and neck extension test, and the sit and reach test. The active straight leg raise was assessed using a goniometer. The center of the goniometer was placed on the greater trochanter, the moveable arm aligned with the femoral condyle to bisect the thigh, and the stationary arm bisected the trunk. The subject was asked to lie supine with their legs extended. Next, the subject was asked to lift their leg off the table as high as they could without flexing the knee and the hip flexion angle was measured. Three measurements were taken on each side and the average was used.

For the shoulder and wrist elevation test, the length of the subject's dominant arm from the top of the shoulder to the tip of the middle finger was measured. The subject then laid face down with arms fully extended overhead and they held a yardstick with hands shoulder width apart. With their chin touching the floor, they raised the yardstick overhead as high as they could as the researcher recorded their highest lift with a yardstick, which was perpendicular to the floor.

For the trunk and neck extension test, the subject sat in a chair and the researcher measured from the tip of their nose to the seat of the chair. The subject then laid face down on the floor with hands crossed behind their lower back and then lifted their trunk as high as possible off the floor while a researcher held their hips down on the floor. Another researcher held a yardstick near the subject's head and measured the height reached between the floor and tip of the nose and recorded each lift (Fahey et al. 2009).

The sit and reach test (Assess Pro Trunk Flexibility tester, Gopher, Owatonna, MN) required the subject to remove their shoes and place their feet flat against the box, keeping their legs straight. The subject reached forward with palms facing down and hands on top of one another as they slid their hands along the line, pushing the lever forward as far as possible while keeping the legs straight (Fahey et al. 2009). The subjects were given three attempts and the best score was recorded.

The final physical assessment test was a basic overhead squat to observe if the subject was able to keep their heels flat, feet still, arms overhead and their head and chest facing forward (Cook 2003). The subject performed three squats to allow testers enough time to observe the four criteria previously mentioned. They received one point for performing each of the aforementioned criteria, for a possible total of four points. Pre- and post-tests for all of the assessment tests were conducted for comparison.

At the end of the 5-week exercise class, the subjects were asked to complete the PAGEQ (Lox et al. 2006). The following four areas were assessed from the PAGEQ: individual attraction to the group task (ATG-T), individual attraction to the group social (ATG-S), group integration task (GI-T) and group integration social (GI-S).

Class Structure

The 5-week exercise class met twice a week for 45 min and emphasized postural and corrective movement exercises. The class design consisted of a warm-up of approximately 5 min of dynamic movements, followed by approximately 20 to 25 min of lower and upper extremity strength training with the medicine ball, elastic band, and stability balls. The stretching portion of the class consisted of 10 to 15 min of static and dynamic stretching of the upper and lower extremity. The participants were also given a packet of stretching and postural exercises that could easily be performed while sitting at their desk or at home (Table 2). They were encouraged to perform these exercises 2-3 times a week. A Certified Strength and Conditioning Specialist and the investigators of this study selected the exercises for the classes. Some exercises were modified to meet individual physical fitness levels. Foam roller back stretching and strengthening exercises were included during the last week of the course.

Table 2. Postural and flexibility exercise homework

Posture Exercises	Stretches
Chin Glides	Chest
Breastbone Lifts	Hip Flexor
Shoulder Blades Squeezes	Hip Abductor
Wall Angels	Hamstring
Prone Lying Scapular Squeezes	Hip Adductors
Pelvic Tilts	Neck Stretch
Bridging	Piriformis
Isometric Abdominals	Torso

Data Analysis

Data were analyzed using dependent t-tests (α = 0.05) and M±SD (SPSS 18.0, Chicago, IL). The average for each of the subscales from the PAGEQ was calculated; a mean score closer to nine indicates a greater attraction to the task or social aspect of the program. The ATG-T was calculated using questions 1, 4, 6, 7, 9, and 11 from Part A. The ATG-S was calculated using questions 2, 3, 5, 8, 10, and 12 from Part A. The GI-T was calculated using questions 2, 4, 5, 8, and 9 from Part B. Lastly, the GI-S was calculated using questions 1, 3, 6, and 7 from Part B.

RESULTS AND DISCUSSION

The purpose of this study was to examine the effects of a five-week exercise program on posture and physical fitness in university female employees. In addition, group cohesion was evaluated to determine why females were attracted to the exercise program. The results indicated there was a significant improvement in core muscular endurance, lower body flexibility, and range of motion in female employees. The inclusion of postural exercises did not show a significant improvement (4%) over the five-week program. The results of the PAGEQ suggested that females were attracted to the group because of the task (ATG-T). This score was the highest (8.2 out of 9.0) and indicated subjects' felt they accomplished more from the task aspect than from the social aspect of the class.

The results of the dependent t-tests revealed significant improvements in the sit-and-reach (p = 0.04), right and left side bridge endurance test (p = 0.04 and 0.01, respectively), trunk flexor endurance (p = 0.02) and the right and left straight leg raise (p = 0.02 and 0.03, respectively). There were no significant improvements in the postural, shoulder and wrist elevation test, and the trunk and neck extension test (p > 0.05). See Table 3. The M±SD for the PAGEQ subscales were: ATG-T = 8.21±0.84, ATG-S = 5.80±1.35, GI-T = 5.54±1.03, and GI-S = 4.25±1.41 (Figure 1). A mean score closer to nine suggests a greater attraction toward the task or social aspect of the program.

Table 3. Mean (±SD) of postural and physical fitness assessments (N = 7)

Variable	Pretest	Posttest	P
Sit-and-Reach (cm)	27.5±7.9	58.3±11.2	0.04
Right Side Bridge	26.1±18.5	38.7±12.0	0.04
Left Side Bridge	21.9±8.9	36.0±15.6	0.01
Trunk Flexor Endurance (s)	29.9±14.0	43.3±16.2	0.03
Right Straight Leg Raise (degrees)	76.3±10.5	86.7±9.6	0.04
Left Straight Leg Raise (degrees)	71.9±8.8	84.6±13.3	0.03
Trunk and Neck Extension (in)	15.9±3.7	14.9±4.5	0.43
Shoulder and Wrist Elevation (in)	20.7±1.6	20.0±2.2	0.41
Posture Evaluation (pts)	52.6±8.2	55.0±4.8	0.61
Squat Evaluation (pts)	3.6±0.8	3.9±0.4	0.46
Body Mass (kg)	59.2±10.9	58.3±11.2	0.23
Body Fat (%)	28.0±7.5	28.5±7.6	0.60

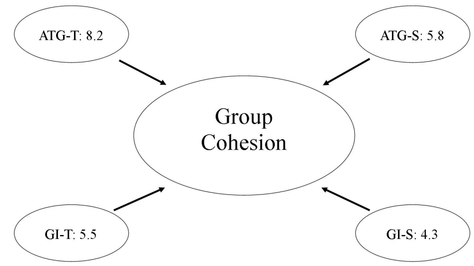

Figure 1. This conceptual model demonstrated how the individuals in the study felt about group cohesion in the exercise class. The four areas were assessed from the PAGEQ: individual attraction to the group task (ATG-T), individual attraction to the group social (ATG-S), group integration task (GI-T) and group integration social (GI-S).

Subjects in the present study significantly improved lower body flexibility and core muscular endurance; however, upper extremity flexibility and posture showed no change over the five-week program. The subjects' initial postural score was classified as a mild deviation (19% deficiency). These results are supported by Roddey et al. (2002) who found increases in flexibility following a two-week stretching class and Harman et al. (2005) who reported no significant changes in posture following a four-week postural strengthening course. In addition, subjects in the Harman study stated improvements in neck strength and range of motion. The exercise program in the present study focused on the whole body rather than targeting a particular body segment. Previous research has shown stretching and resistance training exercises aimed at specific areas have demonstrated improvements in poor postural habits (Barret et al. 2010; De Fonseca et al. 2009; Falla et al. 2007; Leavey et. al 2010; Kluemper et al. 2006; Rougier et al. 2006). However, Zemkova (2009) recommended the inclusion of exercises to improve physical fitness, in general, as well as exercises to correct posture.

The PAGEQ survey measures group cohesion in exercise and physical activity settings to determine if individuals are attracted to the social and/or the task-related aspects of the class (Lox et al. 2006). It assessed whether individuals were interested in joining an exercise classes for social benefits, such as making friends, or if individuals are more interested in the task of the exercise class, like increasing strength or losing weight. Within this study, the subjects scored the highest in the ATG-T section of the PAGEQ. This might suggest the subjects were more concerned with the exercises that focused on stretching and strengthening the muscles to improve their overall fitness level. Loughead et al. (2008) examined the impact of a fitness leader's behavior on group cohesion and the exerciser's affective state following an exercise group session. They also reported the highest score on ATG-T. Another study by Fraser and Spink (2002) focused on the relationship between social support, interest in the task of exercise, and adherence rates in females who were in an exercise program because of medical reasons. This study found that higher scores on the ATG-T scale of group cohesion were related to increased attendance because individuals felt satisfied with the results of the exercise class due to the task aspect. Thus, previous research supports the findings of this study and suggests university female employees may be more attracted to the task aspect of an exercise or physical activity program.

One limitation of this study may have been the short duration of class since it only met twice a week for five weeks and it did not specifically focus on postural exercises. Longer class duration may have a greater impact on the social aspect of group cohesion giving the participants more time to interact with one another. Also, the subjects were given postural strengthening and stretching exercises to complete as homework. However, their compliance with the home exercise program was not assessed. Subjects knew their pretest scores; thus, they may have been motivated to improve their posttest scores on the fitness tests. The overall attendance rate of the subjects was 84%. There was no control groups used to determine the effects of the exercise program. Finally, the sample size was small and all of the subjects were females.

Future research studies could examine the differences between males and females on group cohesion following an exercise class or a targeted exercise program. Or the inclusion of an ergonomic assessment to address posture during every day tasks in addition to an exercise program. The same study could be repeated and controlled for the limitations found in the present study. Lastly, individuals with moderate or severe postural deformities could be recruited to assess the effects of a general exercise program on posture.

In conclusion, the five-week exercise program significantly improved lower body flexibility and core muscular endurance. Thus, wellness initiatives that address postural and corrective movement exercises within a strength and flexibility program may be important for preventing chronic pain associated with poor postural habits. In addition, a high score for ATG-T could improve exercise adherence since people would attend because of their interest in the task. Thus, it is important to design an exercise program where members have a high ATG-T because they are more likely to stay in the program and to see fitness improvements than those who have a low ATG-T.

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