

**STRETCHING EXERCISE AND THE PREVENTION OF OSTEOARTHRITIS FOR
EFFECTIVE JOINT INTEGRITY AMONG THE AGING BASED ON GENDER IN
CALABAR MUNICIPALITY OF CROSS RIVER STATE**

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ABSTRACT

This study examined the effect of the stretching exercise (SE) therapy in the prevention of Osteoarthritis (OA) {range of motion (ROM), muscle torques (MT), and knee flexibility (KF)} for effective joint integrity among the ageing based on gender in Calabar Municipality of Cross River State. Quasi-experimental of pretest posttest research design was employed. Sample of 22 was used. The data were collated using standardized instrument and SEMS. Three types of stretching exercise adopted were Knee lift, Hamstring curl, and Shallow slide lunges. Data were analyzed using percentage, and mean. Results revealed that majority of the participants were males (63.6%), with severe knee pain (40.9%), and majority of those participants had mild pain (63.6%) closely followed by those with no knee pain after the intervention (18.2%). Results showed increased in mean ROM_{flexion} and ROM_{Extension} after the SE (ROM_{flexion} $\bar{x}_{\text{posttest}}=116.19>101.21$; ROM_{Extension}, $\bar{x}_{\text{posttest}}=2.68>1.09$). The pretest mean score for KF was less than mean posttest score ($\bar{x}=4.214<5.637$), implying that three weeks SE has the propensity of improving the KF of the elderly. Results also revealed a significant difference in peak torque in each group (Ex/Con, Ex/Ecc, Flex/Con, and Flex/Ecc) after SE. Male participants' mean ROM, KF, and MT were more improved than that of the females. Lack of awareness of the benefits of SE, fear and poor interest were suspected as the cause. It is recommended that government and health centers should established programmes and exercise centres for the elderly to improve advocacy and enhance their commitment to stretching exercise.

Keywords: *Stretching Exercise, Osteoarthritis, Ageing, Prevention, Joint Integrity Introduction*

The investment in enhancing the viability of joint integrity in a human body is vital in the promotion of quality wellbeing and sustaining life. Quality joint integrity guarantees flexibility, relaxability and quality of life. Joint integrity entails the functionality and optimization of quality support to human body frame. World Health Organization (2018), considers the joint integrity as the state of stability of a joint where in its physiological mechanisms are intact, allowing smooth and co-ordination movement with no infectious instability and or deformity. Put differently, it is the capacity of a joint structural components to withstand strain, pressure but allow normal movement, maintain proper alignment, strong connective tissue and quality performance throughout an individual lifetime (American Academy of Orthopedic Surgeons (AAOA), 2016). Human body joint serves as basement that coordinate the easy movement of human body frame. Juneja et al (2025), posited that joint plays significant role in enhancing movement, stability, flexibility and prevention of deformity between the articulating bone in the human body. Nevertheless, the viability of joint integrity is a function of diverse factors, part of which are size, body weight, shape, arrangement of the articular surface, prevention from injury, and engagement in physical activity. Another most argued variables that exert pressure on joint integrity is the case of aging and gender (Potekhina et al., 2019).

Aging is a wonderful stage in human life characterized with diversities of constraints that in many occasions constitute high level of discomfort to the expected quality of life. Chalise (2019), defines it as the physical or physiological changes that appear over a period of lifespan. It is considered a stage of decline in the functionality of human body, joints, cells and muscles among others especially when proper care is not employed by an individual. Loeser (2010), emphasized that aging leads to the increased activity of a number of cytokines and chemokines in joint tissues which drive matrix degrading enzymes as well as changes in the musculoskeletal system through risk factors such as abnormal biomechanics, joint injury, genetics, and obesity. Studies highlighted that these challenges may contribute to OA (Petrigna et al., 2022).

Sen (2024), defines osteoarthritis as an acute condition characterized by the degeneration of cartilage in the joint, that cause pains, stiffness in the joint, and decreased morbidity. This OA affects the knee, hips, spines, hands and fingers. Causes of OA include age, gender, injury and degradation of the collagen and proteoglycans in cartilage, leading to fibrillation, erosion and cracking in the superficial cartilage layer, symptomatic pains, of OA includes decrease in joint range motion, stiffness, joint effusion and swelling and reduction in quality of life (Ekediegwu et al., 2022).

Statistics has shown that globally, 1 in 6 people above 60years, implying that 16 percent are categorized into this stage of life (Bloom & Lucam 2016, WHO, 2025), with women forming 54percent (WHO, 2025). In Nigeria, 4.9 percent of the population is aging (National Bureau of Statistics, 2024), this indicates that when adequate care is not taken, the mortality and morbidity ratio rises. According to Yahaya et al (2021), the challenges of OA contribute to the rising level of mortality in Nigeria due to the associating pains, and excruciating discomfort emanating from the pains of cartilage degeneration. Research showed that between 2015 to 2025, Nigeria records approximately 11% to >20percent in observed/studied estimate of OA as compared to that of 2005 to 2014 which was 0.4 to 19.6percent in observed/studied estimate of OA (Usenbo, et al., 2016). This trend may not be unconnected with the individual lifestyle, lack of information on the care for aging and OA, unavailability and inaccessibility to functional health care services, and gender based cognitive reasoning about health (Ogunyemi, et al., 2025, Raji, 2023, Amedari & Ejidike, 2021, Ezeaka et al., 2025). Prevention of OA implies effective planning for the elimination of possibility or advancement of OA in the human body. This involves assurance of sustaining the viability of the joint integrity, facilitation of the healthiness of the joint cartilage, and enhancing the regenerative ability of cells, tissues and muscles composites of joint. In other words, it involves the reversal of any course that may results in joint failure (Petrigna et al., 2022, Antony et al., 2015).

Studies revealed that exercise could contribute remarkably in this direction (Li, et al., 2024, Warneke, et al., 2025, Weng et al., 2009). Antony et-al (2015), associated exercise to have significant effect on cartilage volume, cartilage deformation, and in turn, increase blood flow to the connective tissues of the joints and prevent cartilage deterioration. Petrigna et al. (2022) emphasized on the importance of exercise on the cartilage structure. Stretching exercise involves deliberate flexing of specific muscle or tendon (or muscle group) in order to improve the muscle's flexibility and achieve vitalized muscle tone. Different types of stretching exist including ballistic, dynamic, static, and proprioceptive neuromuscular facilitation (PNF) (Gulam, 2015). Each of these stretching as promoted could assists in improving flow of blood to the muscles, reduce muscle aches, calm nerves or relax their bodies, as well as improving range of motion.

Calabar Municipality, a regional health center with tertiary services (University of Calabar Teaching Hospital) and several secondary hospitals, is home to a growing population of older adults, yet the local epidemiology and burden of OA in Calabar are poorly documented. Existing community studies from Calabar highlight substantial burdens of age-related health problems among older adults (for example, high prevalence of metabolic and cognitive conditions), underscoring the need to study other age-related conditions such as OA in the same setting. The absence of robust, local data on OA incidence, clinic caseloads, severity at presentation, and current conservative management practices (including stretching and exercise interventions) limits the ability of clinicians and public-health planners in Calabar to design, implement, and evaluate targeted prevention and rehabilitation strategies. It is against this backdrop, that this study was conducted, because stretching and specific exercise programmes are low-cost, scalable interventions with potential to reduce pain and improve function in early OA, determining their preventive value and practical uptake among aging residents of Calabar is both clinically relevant and policy-useful. This study therefore, sought to examine the effect of stretching exercise on joint health, to assess the viability of three weeks stretching exercise for the aging in Calabar Municipality of Cross River State.

Purpose of the study

The study examined the effect of the stretching exercise (SE) therapy in the prevention of OA for effective joint integrity among the ageing based on gender in Calabar Municipality. The specific objective was to examine the effect of SE on the participants' range of motion, muscle torques, and flexibility.

Methodology

The study adopted quasi-experimental of pretest posttest research design. The design was adopted to measure changes in knee joint flexibility, muscles torque and range of movement before and after the stretching exercise with no control group. The population of the study was 24 elderly people from the University of Calabar Teaching Hospital, above 60years of age. Sample was 22, derived using convenience simple random sampling technique. The criteria for the selection of the sample were: those with no specific knee injury, the willingness of the participants to be regular in the stretching sessions, and those with history of knee pains.

The data were collated using standardized instrument and the researcher's designed scale entitled: "Stretching Exercise Measurement Scale (SEMS)". Standardized instrument utilized were: An isokinetic dynamometer (for the measurement of knee joint torque in Newton meter (N.m)), Hamstring ruler and box (for the measurement of joint flexibility), and Goniometer (for the measurement of joint range motion (ROM)). This was done according to Santos et al. (2017) parameters. The SEMS elicited participants' information including age, gender, participation in stretching exercise, awareness of the impact of stretching in the management of OA, the level of pains experienced by the participants before and after the intervention. For emphasis, pains were measured in five categories: No pain (NP):1, mild pain (M₁P): 2, moderate pain (M₂P): 3, severe pain (SP): 4, and very severe pains (VSP): 5.

The following were the procedure for the SE:

- i. Participants were taken through two-minute aerobic exercise to warm the body and prepare their minds for the SE.
- ii. The participants were taken through each of the three SE (Knee lift procedure, Hamstring curl, and Shallow slide lunges). The SEs adopted are done as stated thus:
- iii. Knee lift procedure: The participants stood up straight, bring their feet together. Lift their right knee and then their left knee, touching both hands to the knee being lifted. For a more challenging dynamic stretch, the participants lift their knee high enough to grasp the top of their shin with hands and pull their leg gently in toward their body, then released it.
- iv. Hamstring curl procedure: The participants stood up straight with their feet hip width apart. Alternately brought their right foot, then left foot, toward the buttocks. Pressed their arms backward.
- v. Shallow slide lunges: The participants stood up straight with their feet in a wide stance, toes pointing forward. Alternate shallow lunges to the right and the left, hinged forwards at the hip and brought both hands to their upper thigh on the lunge.

The participants were briefed on the essence of the exercise, the procedures involved and the duration the study expected to last as well as the benefits expectation. The exercise was carried out in the University of Calabar Teaching Hospital as well as Prime Physiotherapy Laboratory. At first, details of the participants were gathered using SEMS. This was followed by the pretest assessment of the participants' knee flexibility, range of motion and muscle torque using standardized instrument. The documentation of these details formed the pretest data. The third stage involved the engagement of the participants in three days per week of three stretching exercise with each session lasting for 30 minutes. Meanwhile, each stretch held for 15seconds. Three types of stretch employed were hamstring curls, shallow slide lunges and knee lift. The fourth stage was the procedure for the measurement of flexibility using sit and reach test approach. The participants were asked to remove shoes and place their feet against the testing box while sloshing on the floor with straight knees. Thereafter, each of them was asked to placed one hand on top of the other so that the middle fingers of both hands are together at some length. The participants kept their hand on the knees. In each of the cases, the participants leaned forward and placed hands over the measuring scale as far as possible without bouncing but aimed for the farthest position for at least one second. After two trials, the highest score was recorded.

The fifth stage involved the measurement of muscle torque. The participants were asked to be seated, leaned against a backrest inclined at 16° from the vertical and with the seat inclined 6° from the horizontal. The researcher ensured the axis of the knee aligned with the axis of the dynamometer exercise arm. The accuracy of alignment was examined by allowing the participants to extend the leg towards the shin pad, which was positioned over the lower third of the leg. The inability for effective movement towards the pad implies the alignment with the axis of the exercise arm. The angle at which knee flexor muscle shortening began (start angle) was set at 18° from the horizontal and the angle at which muscle lengthening began (return angle) was set at 85° from the horizontal. The estimation of torque was done by calculating the distance between the point of application of the generated force and the axis of rotation of the exercise arm using the scale on the arm itself, and recorded by the SEMS. Exercise-arm velocity was set to 30° /second for the isokinetic peak torque measurements. The final stage of the study was the measurement of the participants' three variables under consideration, alongside the assessment of pains. The standardized instruments were used. The collated data were analyzed using percentage, mean and standard deviation.

Results

Table 1: Respondents' details

Variables	Frequency	Percentage (%)
Age:		
60-65yrs	14	63.6
66-70yrs	6	27.3
71yrs above	2	9.1
Gender:		
Male	14	63.6
Female	8	36.4
Pre-Knee Pains Assessment:		
NP	0	0
M ₁ P	2	9.1
M ₂ P	7	31.8
SP	9	40.9
VSP	4	18.2
Post-Knee Pains Assessment:		
NP	4	18.2
M ₁ P	14	63.6
M ₂ P	2	9.1
SP	2	9.1
VSP	0	0
Participation in SE Before		
Yes	4	18.2
No	18	81.8
Awareness of the benefits of SE		
Yes	6	27.3
No	16	72.7

(Source: Field data, 2025) Table 1 revealed that majority of the participants were those within the age bracket of 60-65yrs of age (63.6%). Males were the majority among the participants (63.6%). Majority (72.7%) of the participants agreed that they were not aware of the effect of SE in preventing OA, and as well, did not participate in SE before (81.8%). The analysis showed that before the stretching exercise intervention, majority of those with severe knee pain (40.9%). However, after the intervention, majority of those participants had mild pain (63.6%) closely followed by those with no knee pain. This is an indication that intentional engagement in stretching exercise has the potency to reduce knee pains. The findings aligned with the findings of the study done by Warneke, et al., (2025), Li, et al. (2024), and Weng, et al. (2009) which revealed that patients engaging in stretching exercise experienced significant reductions in knee pain. This perhaps could be due to the enhanced flexibility of the muscles within the joint that allows flow of blood and the revival of the cartilage vitality. The findings also corroborate with the results obtained

by Dewi, et al. (2023), Sukadiono (2024), Sembiring, et al. (2025) which revealed that stretching decrease in silent pain and movement pain.

Table 2: Analyzed mean and standard deviation of the three considered variables under assessment (ROM, flexibility and muscle torques)

Variables	$\bar{x}$	SD	Gender	
			$\bar{x}$	SD
			F	M
ROM _{flexion}				
Pretest	101.21	4.986		
Posttest	116.19	4.014	102.42	4.002
ROM _{Extension}			171.02	3.720
Pretest	1.09	1.241		
Posttest	2.68	1.002	2.01	1.061
			2.69	1.003
Flexibility (using sit & reach test)				
Pretest	4.214	1.714		
Posttest	5.637	1.121	4.622	1.523
			5.532	1.373
Muscle Torque (@ 60secs)				
Ex/Con				
Pretest	21.911	7.810		
Posttest	26.450	6.215	25.620	5.728
Ex/Ecc			26.601	5.230
Pretest	32.410	6.514		
Posttest	48.216	5.621	43.229	5.022
Flex/Con			48.712	5.527
Pretest	22.976	6.992		
Posttest	28.411	6.710	27.738	6.701
Flex/Ecc			28.633	6.211
Pretest	30.216	7.140		
Posttest	32.019	6.526	32.116	6.523
			33.003	6.433

ROM means range or motion, Ex/Con stands for knee extension with concentric quadriceps contraction; Ex/Ecc means knee flexion with eccentric quadriceps contraction; Flex/Con, knee flexion with concentric biceps femoris contraction; and Flex/Ecc for knee flexion with eccentric biceps femoris contraction.

Table 2 indicates that the mean ROM_{flexion} after the stretching exercise intervention was better improved than the pretest session ($\bar{x} = 116.19 > 101.21$). Based on the participants' gender, male were better than their female counterparts when exposed to the intervention (M, 171.02 > F, 102.42). This was similar with the mean of ROM_{Extension} ($\bar{x} = 1.09 < 2.68$) and posttest experienced based on gender (M, 2.69 > 2.01). The implication is that SE has the potentials of improving range of motion of the participants vis-a-vis reducing chances of joint disability among the elderly. This aligned with the study conducted by Dewi, et al. (2023), Sukadiono (2024), which showed that stretching exercise increased range of motion in active and passive flexion, and external rotation. The results is similar with the study done by Sembiring, et al. (2025). Nevertheless, the disparity based on gender in favour of the male participants could be attributed to the intentionality and informed interest shown by the male as compared to the unwillingness disposition and incessant complaint of stress and fear nurtured by the women. Be that as it may, the findings relatively corroborated with the results of studies done by Akosile, et al. (2021), Akosile, et al. (2014), Okoye, et al., (2022), which revealed that many exercises are dreaded by the aging population, with male participated more than their female counterparts (Lee, 2005, McCarthy & Warne, 2022).

In regards to the knee flexibility of the participants, the findings in Table 2 showed that the pretest mean score was less than the mean posttest score ($\bar{x} = 4.214 < 5.637$), implying that the three days per week of three weeks SE has the propensity of improving the flexibility of the knee of the elderly. The difference of 1.423 in the mean SE intervention is significant to sustain the knee flexibility of the elderly. The finding was supported by Sukadiono (2024), Sembiring, et al. (2025), Gulam (2015) which showed that SE reduces muscle stiffness around the knee and promotes flexibility. However, though the improvement is irrespective of gender, the analysis showed male participants having a much better knee flexibility mean score than their female counterparts. The analyzed findings based on gender could be attributed to the self-determined motivation that command interest, attention, and passion male participants shown while participating in the SE as compared to their female counterparts that exhibited somewhat unassuming tendencies during the SE. The finding is supported by Lauderdale, et al. (2015) that differences that exist in the participation in exercise based on gender is a function of selfdetermined motivation.

For the effect of SE intervention on the muscle torque of the participants, the findings indicated a significant difference in peak torque in each case (Ex/Con, Ex/Ecc, Flex/Con, and Flex/Ecc) after the intervention (posttest assessment). The findings aligned with the results obtained by Warneke, et al., (2025), Li, et al. (2024), and Weng, et al. (2009) that showed significant increase in peak

muscle torques after treatment with SE. The difference equally exists based on gender, favoring male better than their female participants. A situation which may be related with self-determined motivation and fear among the female (McCarthy & Warne, 2022, Lauderdale, et al., 2015).

Conclusion

The analyzed data revealed that stretching exercise has the potentials of preventing Osteoarthritis for effective joint integrity among the ageing. This is related to its effectiveness in improving joint flexibility which guarantees increase in the blood flow to the connective tissues of the joint and preventing cartilage deterioration. Also, the SE increased the peak muscle torques as well as enhancing the improvement of knee range of motion. Nevertheless, the SE was better in the prevention of male participants OA for effective joint integrity than that of the females. Therefore, it is concluded that the potentials of SE in guaranteeing effective prevention of OA for effective joint integrity among the aged is a function of the zeal, seriousness and the commitment of the people to the stretching exercise.

Recommendations

It is recommended that:

- i. Families should encourage their ageing relatives to engaged in stretching exercise to sustain their vitality and improve joint integrity.
- ii. Government should establish programmes as well as exercise centres for the elderly to improve advocacy and enhance their commitment to stretching exercise. This will in a long run eliminate fear among the ageing in regards to the participation in the stretching exercise, unbundled the society of the rising level of Osteoarthritis and the associated death, guarantees quality of life, and assured longevity.

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