EVALUATION OF A NEW PHYSICAL EXERCISE TAKEN FROM *SALAT* (PRAYER) AS A SHORT-DURATION AND FREQUENT PHYSICAL ACTIVITY IN THE REHABILITATION OF GERIATRIC AND DISABLED PATIENTS

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Background: The major function of rehabilitation and physical medicine specialists is to provide the proper therapy that helps in improving the physical activities of impaired, disabled and handicapped persons through improvement in their muscle strength. In performing their function, the rehabilitation team should always take heed of the social and mental well-being of such patients. Having observed millions of Muslims perform the *salat* (prayer) regularly at specified times throughout the world, we postulated that *salat*, along with its various postures, can play a role in increasing psychological well-being including self-reliance and self-esteem, improving musculo-skeletal fitness, motor behavior and cerebral blood flow that may be beneficial in the rehabilitation of geriatric and disabled persons.
Subjects and Methods: The various postures of *salat* were studied and a range of joint motions were measured by goniometer, an instrument for measuring angles. Brain blood pressure was calculated from the effect of gravity on blood pressure at different positions.
Results: We found that during the offering of *salat*, most of the joints and muscles of the body were involved in physical activities with little effort, which probably play a vital role in cerebral blood flow and postural reflexes.
Conclusion: The physical activities involved in the performance of *salat* helps in the rehabilitation process in disabled geriatric patients by improving blood flow and increasing muscoskeletal fitness. The *salat* prayer involves little effort (standing, bowing, prostration and sitting), has a short duration and is beneficial for mental and physical health. More studies are needed in future to determine the full beneficial effects of the *salat* prayer on the rehabilitative process of disabled persons.
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Key Words: *Salat* (prayer), Muslim, psychology, musculo-skeletal system, disability, rehabilitation.

Salat is the Arabic word for prayers offered by Muslim worshippers, and is the second pillar of the Islamic faith. The various aspects of the prayer ritual include standing, bowing, prostration and sitting. Before performing the prayers, worshippers must brush their teeth, wash the oral and nasal cavities, face, raise the hands up to elbows, and feet up to the ankle. These types of self-care tasks are performed routinely by able-bodied persons, but they can become extraordinary challenges for persons with cognitive, motor, or sensory impairments and disability.[1] Worshippers usually wear loose garments during prayers, which are usually conducted in a calm environment which helps to concentrate the mind of the worshipper. This type of mind concentration has a tranquilizing effect and is different from conventional meditation.

Salat is a physical as well as a spiritual act involving total obedience and submission to Allah (God). The act of prayers is obligatory for all Muslims. The aim of this paper is to emphasise the therapeutic value of *salat* as a physical exercise of the musculoskeletal system for geriatric and disabled or handicapped people in rehabilitation programs.

Methods

The pattern of the *salat* prayer performed by Muslims is similar all over the world. In our study, the motion of joints during *salat* was measured by a goniometer commonly used by clinicians. We examined the active range of motions for each of the joints that were involved during *salat*. A goniometer has two arms with full-circled scales marked in degrees. It was placed on the joints at different postures of

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TABLE 1. *The joints and muscles of standing.*

Joint	Type	Motion	Muscles	Normal limit and range of motion (ROM) in degrees	ROM during salat in degrees
Shoulder	Synovial ball and socket	Internal rotation	Anterior fibres of deltoid, pectoralis major, teres major, latissimus dorsi and subcapularis	0-90	90
Wrist	Bi-axial ellipsoid	Flexion	Flexor carpi radialis, palmaris longus, flexor carpi ulnaris	0-90	60
		Extension	Extensor carpi radialis longus and brevis, extensor carpi ulnaris	0-70	35
Elbow	Hinge	Flexion	Brachialis, brachioradialis, biceps and pronator teres	0-145	125
		Extension	Triceps and anconeus	0-5	0
		Pronation	Pronator quadratus, pronator teres	0-90	45
Metacarpophalangeal (MP)/proximal interphalangeal/distal interphalangeal	Ellipsoid and plane synovial	Flexion, extension, abduction and adduction	Flexor digitorum profundus, superficialis, doral interossei, palmer interossei, flexor digitiminimi brevis, extensor digitorum, extensor indicis, flexor pollicis longus and brevis, extensor pollicis longus and brevis, abductor pollicis brevis and longus, adductor pollicis	0-90 of MP joint	90
Temporomandibular	Condylar	Mouth opening	External pterygoids, masseter	3 to 6 cm between the upper and lower teeth when the jaw is open, usually mouth opens and closes up to 2,000 times a day	About 2 cm, during salat it is more active because of uttering of verses
		Mouth closing	Temporalis and internal pterygoids		

TABLE 2. *The joints and muscles of bowing.*

Joint	Type	Motion	Muscles	Normal limit and range of motion (ROM) in degrees	ROM during salat in degrees
Vertebral column (thoraco-lumbar part)	Complex type of synovial (symphyses)	Flexion	Rectus abdominis of both side	0-75	65
		Extension	The erector spinae complex, splenius and semispinalis capitis	0	0 (motion occurs from flexion to extension)

TABLE 3. *The joints and muscles of prostration.*

Joint	Type	Motion	Muscles	Normal limit and range of motion (ROM) in degrees	ROM during salat in degrees
Hip	Synovial ball and socket	Flexion	Iliacus, psoas, straight and reflected head of rectus femoris, sartorius	0-90 (with knee extended)	0
		Extension	Glutius maximus, biceps femoris, semitendinosus, semimembranosus, adductor magnus	0-120 (with knee flexed) 0-30 (with knee extended)	70 0
Knee	Synovial hinge and synovial gliding	Flexion	Long and short head of biceps femoris, semitendinosus, semimembranosus, gastrocnemius	0-130	130
		Extension	Quadriceps femoris, long and short head of rectus femoris, vastus lateralis, vastus medialis, vastus intermedius	0-15	0
Ankle	Synovial hinge	Dorsiflexion	Tibialis anterior, extensor hallusis longus, extensor digitorum longus, peronius tertius	0-20	0
		Plantar flexion	Gastrocnemius, soleus, plantaris, peroneus longus, peroneus brevis, tibialis posterior, flexor digitorum longus, flexor hallucis longus	0-45	45 of right ankle at the tie of sitting on leg with flexed knee

salat, and joint angles were measured precisely. Zero degrees were regarded as starting points and motions were recorded as deviation from zero degrees.

Standing for Prayers

Worshippers have to stand and concentrate their minds on praying. A reactive depression is common in geriatric and disabled persons. The determination to pray has a remedial action on depression, and standing helps to develop balance. When people stand comfortably, the center of pressure is usually midway between the instep of the two feet. In a standing position, they raise their hands up to the ear lobe and bring them down one after another by holding the left wrist with the right hand on the abdomen, above the navel, or on the chest. During voluntary clenching of the right hand, blood flow is increased in the hand area of the left motor cortex, and the corresponding sensory areas in the post-central gyrus.[3] What happens to the involved muscles and joints are described in the Table 1.[4-6]

Worshippers utter some verses from *Quran* which is written in Arabic. Like any other language, various muscles

TABLE 4. *The joints and muscles of sitting and finishing*

Joint	Type	Motion	Muscles	Normal limit and range of motion (ROM) in degrees	ROM during salat in degrees
Subtalar	Synovial	Inversion	Tibialis anterior and tibialis posterior	0-30	30 degrees of left ankle
Metatarsophalangeal/ proximal interphalangeal/distal interphalangeal	Ellipsoidal type of synovial	Dorsiflexion	Extensor hallusis longus, extensor digitorum longus and brevis	0-60	60 degrees at the time of prostration
		Plantar flexion	Flexor hallusis longus and brevis, flexor digitorum brevis and accessorius, flexor digiti minimi brevis, lumbricals	0-35	35 degrees at the time of sitting
Atlanto-axial	Synovial	Rotation	Obliqus capitis inferior, rectus capitis posterior major, sternocleidomastoid	0-70	50

are exercised during speech. There is a bilateral increase in blood flow in the face, tongue, mouth sensory and motor areas, and the upper premotor cortex in the brain during speech. During creative speech, there is also an increase in blood flow in Broca's and Wernicke's areas of speech in the brain. Blood flow in the brain can be measured by functional magnetic resonance imaging (fMRI) and positron emission tomography (PET.)[3]

Bowing

After standing and uttering some verses from the *Quran*, bowing is done by forward movement of the vertebral column, especially at the lumbar joint, and supported by two straight hands grasping the two hyperextended knees. After a few seconds, the worshipper gradually reverts to the previous state until the vertebral column is vertical. The joints and muscles affected in bowing are shown in Table 2.[4-6]

Prostration

The act of prostration is the substance of *salat*. It is done from the standing position to kneeling, putting the head down and touching the ground with the forehead, with the palms remaining parallel to the ears, and touching the ground with the flexed elbows for a few seconds. The various motions have a great impact on blood flow in the human brain. Because of variations in arterial mean pressure in the body, prostration helps in improving cerebral circulation and avoiding ischemic brain disease.

Postural reflex, and tonic labyrinthine reflex are initiated by the force of gravity on the receptors of otolithic organs in the utricle of the inner ear, and are effected via the vestibulospinal tracts. Maximal effect occurs in the supine position and minimal effect occurs when the head is down 60 degrees below the horizontal plane in the prone position. The tonic labyrinthine reflex is responsible for the contraction of the limb extensor muscles. Thus, the various positions of *salat* from the vertical natural position to prostration helps in the maintenance of steadiness of postural equilibrium. During *salat*, Muslims usually keep their eyes fixed on the site of prostration. This visual fixation together with proprioceptive systems, vestibular systems, and the various postures provide a complex positional sense in the brain stem and cerebellum[8,9] The joints and muscles involved during prostration are described in Table 3.[4-6]

Sitting and Finishing Salat

After standing and bowing, and proceeding to prostration, sitting is done on the left leg knee flexed with the inverted dorsi flexed ankle and flexed right knee and metatansophalangeal joint for a couple of minutes. After that, *salat* is concluded by looking over one's right and left shoulder wishing peace for mankind. Involving joints and muscles are described in the Table 4.[4-6]

Conclusions

It can be seen from the above discussion that *salat* prayer has psychological, musculoskeletal and cerebral effects on improving the muscular functions of geriatric, disabled and dementic patient in a rehabilitation program. The physiotherapist of the rehabilitation center who assists the patient to restore and preserve joint range of motion through mobilization techniques and exercise may take this prayer system as a model for restoring the residual strength of the patient. Elderly people and disabled person can gain significant health benefits with a mild to moderate amount of physical activity, like the performance of *salat*, preferably daily.

Salat has special characteristics in that it is a short duration mild-to-moderate psychological, physical and brain activity. Scientific evidence also supports the notion that even moderate intensity activities, when performed daily, can have some long-term health benefits (American Heart Association). *Salat* is like a free hand exercise. It can be performed in groups or individually without any equipment. Thus, a person in a rehabilitation program can practice the activity in their room with ease and comfort, even when sitting in a wheelchair or in bed. During the performance of *salat*, most of the muscles and joints of the body are involved. This activity is convenient for all kinds of patients, including children, the elderly and physically handicapped, for strengthening their muscles as well as the mind.

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