Salat (Muslim prayer) as a therapeutic exercise

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Abstract

'Salat' is a Muslim prayer mandatory for all Muslims five times a day. It is comparable to performing a mild-intensity exercise, because most of the joints and muscles undergo exercise during different positions and movements adopted in Salat. Though Salat is practised by all Muslims, evidence is very limited regarding the biomechanics and therapeutic effects of Salat as an exercise. However, literature shows activation of biceps brachii, triceps brachii, pectoralis major, scapular musculature, rectus femoris, biceps femoris, tibialis anterior and gastrocnemius during different postures of Salat. Moreover, Salat is also found to improve balance in healthy individuals as well as stroke patients, decreases the chances of development of knee osteoarthritis, and provide cardiovascular and compositional benefits. The current literature review was planned to look into the current evidence and discuss what is known regarding the effects of Salat and how it can be used as an exercise.

Keywords: Salat, Salah, Namaz, Exercise, Muslim prayer, Biomechanics.

Introduction

An exercise is defined as a physical activity carried out for the purpose of enhancing or maintaining physical health and general fitness.[1] Exercise has been shown to result in both physiological as well as psychological benefits,[1-3] hence individuals exercising regularly are shown to have better health and overall fitness. Suggested amount of exercise per week is 30-60 minutes at least twice or thrice.[1] Exercises can be majorly divided into flexibility, aerobic and strengthening exercises, the intensity of which can vary from mild to moderate to intense, giving different benefits.[1] Salat, also known as 'Namaz', is a type of physical prayer practised by Muslims, and is also a type of meditation.[4] Salat is a mandatory prayer in Islam at least five times a day.[2] It comprises recitations and definite positions that are adopted by a person, including qiyam, rukuk, sujud and tahiyyat, which are derived positions of fundamental standing, bowing, prostration and sitting respectively.[2,3] The act of Salat is comparable to performing a gentle moderate physical exercise.[1] Salat is initiated with takbir, which is the movement of raising hands to the level of one's face so that the thumbs touch the ear lobule, and ends with turning of the head to both shoulders, first right and then left.[3,5] Most of the joints and muscles are stimulated and exercised during the activity of Salat.[1-3,6] In addition to the physiological benefits, Salat also leads to spiritual benefits.[6-11] It is also reported that around 95% of patients perceive that performing Salat 5 times a day will help them keep healthy.[12] Evidence also suggests parasympathetic stimulation during Salat, thus promoting relaxation as in meditation.[2] According to literature, Salat provides cardiovascular, musculoskeletal, postural and compositional benefits.[1-3,7] A study conducted on body composition secondary to the performance of 'Salat-e-Taraweeh', which is a prolonged prayer specially performed during the holy month of Ramadan, showed positive effects on overall health and fitness.[13]

Methods

An online search was performed from December 2016 to July 2017 using different search engines and databases, including Google Scholar, PubMed, Scopus, Cochrane, PEDro, EBSCO and Pakmedinet using Boolean terms to combine key words such as Salat, Namaz, Muslim prayer, electromyography, therapeutic exercise and health benefits etc. Manual screening was also performed in related articles and research journals.

Description of Salat Positions

Salat is initiated with takbir, which is the movement of raising hands to the level of one's face so that the thumbs touch the ear lobule. It is then followed by Standing (qiyam) for up to 60-90 seconds, followed by bowing (rukuk) of 5-10 seconds, and then standing again for 2-5 seconds. The person then moves from standing to prostration (sujud) for 5-10 seconds, followed by sitting (tahiyyat) for 2-5 seconds, and then back to prostration 5-10 seconds, followed by sitting (tahiyyat) for 20-30 seconds.[3] All of this activity concludes a Rakat, and an act of Salat may consist of 2-4 rakats. At the end of Salat the person turns the head to both shoulders, first right and then left.[3,5]

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The Standing (Qiyam) Posture of Salat

The standing (qiyam) position for Salat is a derived form of and is similar to the fundamental standing position. Some exceptions in this position include wrapping of the arms in front of the belly in such a way that scapula are slightly retracted. This may result in activation of the scapular retractors which are usually prone to getting weak as well as stretching of pectoral muscles which are prone to getting short. Another important difference from the fundamental standing in Salat is that chin is tucked in and the person looks at his feet while standing, resulting in flexion at the upper cervical spine, thus activation of the deep neck flexors occurs, which are prone to getting weak as in upper cross syndrome. Standing position is found to have the greatest increase in the heart rate (85±8 bpm) of all the positions in Salat.[3]

The Bowing (rukuk) posture of Salat

The bowing, or Rukuk, is a very important position biomechanically, in which forward bending occurs at the thoracic and lumbar spine which leads to stretching of the paraspinal muscles and structures. The trunk and the lower extremity are at an approximate 90degrees to each other.[3] The person attempts to look between his toes while adopting this position which results in the activation of deep neck flexors which are usually prone to getting weak. The hip joint is in flexion, and knees are extended and the ankle is at 90° with the lower leg as in standing. The position of the spine and lower extremity is somewhat similar to slump position, so bowing or rukuk not only stretches the posterior musculature of the lower limb, including hamstrings and gastro-soleus, but also puts a stretch on the dural components. Thus, it can be used as an exercise for stretching of muscle as well as dura. The shoulders are slightly flexed and elbows are fully extended, whereas the hands rest on the knees. The average duration of a rukuk may last up to 10-15 seconds.[14] The heart rate in bending position for Salat is found to be 80±7 bpm, which is higher than normal heart rate.[3]

The Prostration (sujud) posture of Salat

Prostration or Sujud is a posture similar to a child's pose,[1] and flexion occurs at the thoracic and lumbar spine accompanied with hip flexion. The knees are in mid flexion, the ankle is in neutral position and toes are extended. The shoulders are slightly abducted, elbows in mid flexion and wrists extended with the palms parallel to the ears.[1] The lower cervical spine is also slightly extended during prostration. A single prostration may last up to 10-15 seconds.[14] A study was conducted on 8 male and female university students and the mean and peak values were compared between prostration and child's pose for biceps brachii, triceps brachii, pectoralis major and scapular musculature. The results showed that all of the muscles were activated in both positions, and triceps brachii showed the greatest activation. Triceps brachi in Salat also showed a significant greater activation than the child's pose. The values for EMG during prostration and child pose are shown in Table-1. Prostration is found to have a slight decrease in heart rate during Salat (69±6 bpm).[3] Evidence concludes that prostration during Salat has similar effects on the musculoskeletal system compared to a child's pose which is a stretching exercise.[1] Moreover, based on the body posture adopted during prostration, it is comparable to William's flexion exercises which are often prescribed in the management of back pain and spinal stenosis, as it promotes flexion and stretching of the muscles on the dorsal aspect of the spine and in turn decreasing the stress due to excessive lumbar lordosis.[15]

Table-1: Comparison of Values of Electromyography (EMG) for Muscles of Upper and Lower Body during Prostration and Exercise.[1,18]

		Biceps Brachii	Triceps Brachii	Pectoralis Major	Scapular Musculature	Rectus Femoris	Biceps Femoris
EMG Values	Prostration Pose(Salat)	14.95-39.15[1]	99.35-222.5[1]	25.85-51.1[1]	12.8-32.4[1]	70.18[18]	75.43[18]
	Child Pose	18.05-67[1]	49.1-136.95[1]	26.1-86.6[1]	16.65-79.8[1]		
	Squatting Exercise					78.81[18]	86.86[18]

The Sitting (Tahiyyat) Posture of Salat

The Sitting (tahiyyat) position consists of sitting on the floor with lumbar and thoracic spine in neutral position, hip joint in flexion and knee joint in full flexion, and may last up to 30-60 seconds.[14] This results in a stretching of the quadriceps femoris muscle. The hands are placed on the distal aspect of anterior thigh, with shoulders flexed and elbows extended though full extension is not present, along with slight extension at the wrists. The heart rate in sitting position during Salat is found to be around 74.5± bpm.[3]

Salat as a Musculoskeletal Therapeutic Exercise

During different positions and transitions of Salat, movement occurs at almost all joints of the body,[2]

including shoulder complex, wrist joint, elbow complex, metacarpo-phalangeal joints, inter-phalangeal joints, temporo-mandibular joint during recitation, cervical, lumbar and thoracic spine along with atlanto-axial joint, and joints of lower limb including hip, knee, ankle, metatarso-phalangeal and subtalar joints.[6] The different postures and positions adopted during Salat comprises of contraction and relaxation at numerous muscles, and thus Salat is an excellent physical activity.[2] Numerous positive effects occur at muscles due to regular physical activity and exercise. Literature suggests that with the increasing use of visual display units, prolonged poor posture and sedentary life style musculoskeletal discomfort is becoming increasingly common, with a prevalence of musculoskeletal discomfort as high as 75.7% in neck, 62.5% in low back, 58.8% in upper back, 52.9% in shoulder and 36% in hip.[16] A mild-intensity exercise is advised to prevent build-up of this musculoskeletal discomfort, especially in a static workstation setting in the form of exercise breaks.[17] Thus, Salat being a mild intensity physical activity involving almost all joints of human body, in the form of an exercise break, can effectively prevent the build-up of musculoskeletal discomfort. Salat has also been shown to have positive effects as a frequent short duration physical activity or exercise in rehabilitation of the elderly and disabled.[6] Comparison of Salat with different exercises including toe-touching exercise (TTE) and squatting exercise (SE) in terms of percentage maximum voluntary contraction (MVC) and muscle activation of rectus femoris, biceps femoris and gastrocnemius shows no significant difference ($p>0.05$) except for tibialis anterior ($p<0.05$)[2] (Table-2 & 3). One study compared prostration with child's pose exercise and found similar effects in both positions in terms of muscular activation, except for triceps brachii which showed a significantly greater activation.[1] Another study compared prostration with SE and found activation of lower limb musculature, including prostration and SE.[18] In addition to muscles of the lower limbs, the muscles of spine and perineum are also activated repeatedly during Salat.[19] Literature suggests that regular practice of Salat results in decreased chances of development of knee osteoarthritis.[20,21] This is perhaps because of the way the Muslim prayer (Salat) is performed, in which knees go into deep flexion, stretching soft tissues around the knee joint, resulting in decreased knee stiffness and articular cartilage contact pressure.[20,21] A study conducted in Thailand compared the occurrence of knee osteoarthritis between Buddhist and Muslim elderly population, and found that the prevalence of radiographic knee osteoarthritis and symptomatic osteoarthritis was significantly higher in Buddhists compared to Muslims, but no significant differences in knee range of motion were observed.[20] A preliminary study conducted in 2013 also suggested Salat as an alternative therapy with beneficial effects on individuals with erectile dysfunction, with largest effects observed in maximum percentage of volumetric change.[22]

Table-2: Maximum Voluntary contraction for different muscles during Salat and Exercise.[2,18]

Muscle	EMG average in Percentage Maximum Voluntary Contraction	
	Salat	Exercise
Rectus Femoris	33.89[2] ,70.18[18*]	35.58[2], 78.81[18]
Biceps Femoris	15.13[2], 75.43[18*]	16.38[2], 86.86[18]
Tibialis Anterior	15.10[2]	20.77[2]
Gastrocnemious	21.09[2]	21.26[2]

*Indicate Mean Values in Prostration and not overall salat.
EMG: Electromyography

Table-3: Muscular Activation of different muscles of lower limb during different positions of Salat and different exercises.[2,18]

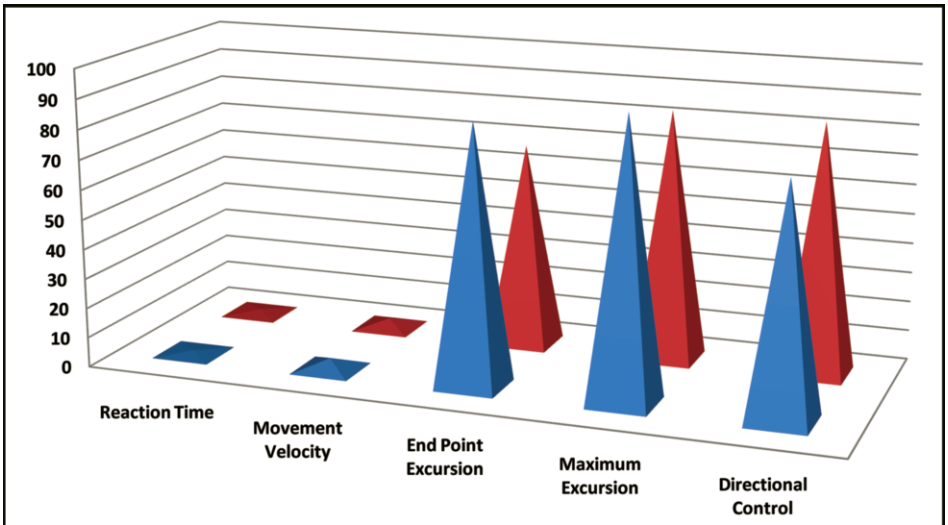
Position	EMG activity
Rectus Femoris	
Standing Position (Salat)	36.41[2]
Prostration (Salat)	78.81[18]
Squatting Exercise	36.912, 78.81[18]
Biceps Femoris	
Bowing (Salat)	15.23[2]
Prostration (Salat)	86.86[18]
Toe Touching Exercise	16.60[2]
Squatting Exercise	86.86[18]
Tibialis Anterior	
Bowing (Salat)	15.02[2]
Toe Touching Exercise	20.54[2]
Gastrocnemious	
Bowing (Salat)	20.71[2]
Toe Touching Exercise	21.03[2]

($P<0.05$) only for Tibialis anterior.
EMG: Electromyography.

Effects of Salat on Heart Rate and Blood Pressure

Salat is a type of meditation exercise as well and evidence shows meditation results in a decrease in both systolic and diastolic blood pressure and thus can be of benefit to moderately hypertensive individuals.[23,24] Numerous studies have also shown that this positive influence wears off as meditation is discontinued.[25] Evidence suggests a correlation between meditation and the body postures adopted on heart rate, blood pressure and other haemodynamic factors such as yoga.[25-27] Evidence also suggests Salat and yoga together having positive effects on mental health.[28] Heart rate and blood pressure is also

found to decrease during meditation and long-time practice of meditation has been proven to result in marked decrease in heart rate of individuals,[23,24] in addition to positive effects on stress, anxiety, depression and sleep quality.[29] Positive changes in heart rate in relation to activity of Salat have also been reported.[30] A study showed significant difference in the heart rates of subjects between performing Salat with recitation and miming Salat.[3] Heart rate associated with actual Salat was significantly higher than mimed Salat ($p<0.05$).[3] The mean heart rate for actual Salat for standing, bowing, prostration and sitting was 85±8, 80±7, 69±6 and 74±5 beats per minute. Whereas the mean heart rate during mimed salat was 82±5, 78±5, 67±4, 71±4 beats per minute respectively. Standing position was shown to result in the highest heart rate and on the other hand prostration showed the lowest heart rate compared to other positions.[3] The most important effect was a significant decrease in blood pressure after both actual and mimed Salat ($p<0.05$).[3] The blood pressure was found to be significantly lower after performing actual Salat compared to mimed Salat ($p<0.05$). The systolic blood pressure for actual Salat with recitation was 118.0±5.6 mmHg before and 115.0±4.7 mmHg after Salat respectively. The systolic blood pressure for mimed Salat with recitation was 119.3±4.9 mmHg before and 117.0±4.2 mmHg after Salat respectively. Moreover, the diastolic blood pressure for actual Salat with recitation was 72.2±5.2 mmHg before and 70.2±4.0 mmHg after Salat respectively. The diastolic blood pressure for actual Salat with recitation was 73.3±3.8 mmHg before and 72.1±3.2 mmHg after Salat respectively.[3]



	Reaction Time	Movement Velocity	End Point Excursion	Maximum Excursion	Directional Control
Individuals performing prayer regularly	0.94	3.72	87.1	93.5	77.2
Non-practicing individuals	1.11	3	68.67	84.3	84.17

Figure: Comparative mean scores of reaction time, movement velocity, end-point excursion, maximum excursion and directional control scores for individuals performing prayer regularly and non-practising individual.[31]

Salat as a Neuromuscular Therapeutic Exercise

Literature shows that Salat results in the activation of parasympathetic nervous system, and a decrease in sympathetic activity.[14] Perhaps that is why Salat is often considered a form of meditation as it results in decreasing anxiety, promotion of relaxation and an overall decrease in cardiovascular risk.[14] Moreover, performing Salat is also reckoned to stimulate the visual, vestibular and somato-sensory systems, ultimately influencing balance and coordination,[31] just like yoga which is found to influence balance and physical activity in both young and elderly.[32,33] A study in the Kingdom of Saudi Arabia compared the dynamic balance of healthy individuals who performed Salat regularly with non-practising individuals, and found that individuals who performed Salat regularly had a significantly superior dynamic balance ($p<0.05$) in terms of reaction time, movement velocity, end-point excursion, maximum excursion and directional control (Figure).[31] Another study conducted in Pakistan considered Salat a form of activity repetition training and compared the effects of Salat with task-oriented training on the functional outcomes in patients with stroke.[34] The outcome measurement tools included in the cited study were Motor Assessment Scale (MAS) and Berg Balance Scale (BBS). The study found Salat to be superior to task-oriented training in terms of both MSA and BBS ($p<0.05$) after a follow-up of 6 weeks.[34]

Recommendations

The literature on biomechanical aspects and health influences of Salat is very limited. More work needs to be carried out to explore the biomechanics of Salat and the way Salat influences overall health and wellbeing. Current

literature shows activation of different muscle groups during different postures of Salat, including biceps brachii, triceps brachii, pectoralis major, scapular musculature, rectus femoris, biceps femoris, tibialis anterior and gastrocnemius.[1,2,18] But the extent of activation is inconsistent in literature and more studies need to be carried out in this regard. According to the biomechanical perspective of different postures of Salat, muscles of the trunk are also suggested to be activated during Salat, but no evidence exists which shows the extent of muscular activation. Literature has also shown Salat to improve dynamic balance and control in both healthy individuals and stroke patients,[31,34] thus it can be used as a therapeutic exercise in patients with impaired balance. Evidence also shows positive cardiovascular effects due to Salat, including heart rate and blood pressure changes during different postures of Salat,[30] suggesting that it may be used as a mild form of cardio or warm-up exercise. Decrease in heart rate after performing Salat suggests that Salat can also be used as a meditation and relaxation exercise. One study even showed positive effects of Salat on erectile dysfunction,[22] and Salat has also been shown to activate parasympathetic stimulation as well. Another study also shows positive effects of Salat as an exercise in the rehabilitation of geriatric population and people with disability.

Conclusion

Up till now, no evidence exists on joint biomechanics of Salat. In view of the current evidence, Salat can be suggested as a warm-up and mild-intensity exercise providing benefits in terms of cardiovascular system, musculoskeletal system, posture and body composition.

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