RESEARCH ARTICLE

# Timed Up and Go and Five Times Sit to Stand Test among community ambulant, overweight, obese Saudi elderly population

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## Abstract

**Objective:** To investigate the effect of Timed Up and Go category on the Five Times Sit to Stand Test, and to determine the role of recreational status on Timed Up and Go rating.

**Method:** The descriptive, cross-sectional study was conducted between October 2018 and April 2019 at the College of Medical Rehabilitation Sciences, Taibah University, Madina, Saudi Arabia, and comprised community-ambulant retired overweight or obese subjects of either gender aged 60-69 years. Timed Up and Go, Five Times Sit to Stand Test and Single-Leg Stance Test were used to measure basic mobility, transitional skills and static balance respectively. Data was analysed using SPSS 23.

**Results:** Of the 150 subjects, 108(72%) were males and 42(28%) were females. The overall mean age was 63.1±2.5 years and the mean body mass index was 29.6±3.8 kg/m$^2$. There were 46(31.5%) subjects who were freely mobile, 60(41.1%) who were mostly independent and 40(27.4%) who had variable mobility. Also, 36(24%) subjects were recreationally active, while 114(76%) were recreationally inactive. The freely mobile subjects managed to finish the Five Times Sit to Stand Test in less time than the other groups ($p$<0.05). The recreationally active subjects took significantly less time to finish the Timed Up and Go test compared to the inactive. Besides, the males had longer Single-Leg Stance Test timing than females ($p$<0.05).

**Conclusion:** The elderly belonging to different Timed Up and Go mobility categories demonstrated variable Five Times Sit to Stand abilities, with the recreational mobility status significantly affecting the category.

**Keywords:** Body mass index, Geriatric assessment, Physical capacity, Saudi elderlies. (JPMA 72: 1306; 2022)

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## Introduction

The proportion of older people has increased throughout the world, with the number of people aged 65 or older projected to reach 1.5 billion in 2050.[1] Global efforts are essential to keep older people as independently mobile as possible despite physical limitations. Quality of life (QOL) in old age is related to independent mobility, therefore, healthcare professionals have to work relentlessly to keep older people mobile so that they may take care of themselves to reduce the economic burden on families and society.[1] Physical inactivity is a major threat among the elderly and can be mainly attributed to the presence of co-morbidities, weakness, lack of motivation and energy, and fear of fall.[2] Overweight and obesity statuses are associated with all such threats and the impact becomes dangerous among the elderly.[3] Regardless of the socioeconomic status (SES) in different countries, overweight/obesity has reached epidemic stage and is increasingly evident in high-income countries, like Saudi Arabia,[4,5] where a recent study showed that overweight and obesity prevalence of 38.3% and 27.6% respectively, while gender-specific prevalence of obesity was 29.1% among women compared to 26.2% among men.[6] Overweight and obesity constitute a major challenge among the elderly, and are considered risk factors that reduce physical fitness of young adults, reduce health-related QOL (HRQOL) and jeopardise the state of overall health and wellbeing of individuals.[3,7-9]

A sedentary lifestyle significantly reduces physical capacity, especially among the elderly.[3,10] Overweight/obesity also reduces physical capacity and tends to be associated with inactivity and may eventually result in physical disability, especially among the elderly. Many authors have reported significant increase of physical impairments in the elderly and the subsequent deterioration of physical independence in addition to consequent association of obesity with physical disability.[10] Reduction of physical capacity among the elderly could increase their risk of fall and consequent complications of injuries.[10-12] Overweight and obesity reduce mobility, transitional skills and balance, especially among the elderly which increases the risk of falls, and, therefore, the elderly should maintain adequate mobility, lower-limb strength, transitional skills and balance in order to be independent in terms of functional mobility. The Timed Up and Go (TUG) test, the Five Times Sit to Stand Test (5XSST) and the Single-Leg Stance Test (STST) are widely reported in literature and frequently utilised to respectively assess independent mobility,

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transitional skills and balance among the elderly.[13-15] However, there is insufficient data regarding the level of these functional outcome measures among the retired elderly in Saudi Arabia. The current study was planned to fill the gap by investigating the effect of TUG category on 5XSST and SLST, to determine the role of recreational status on TUG rating, and to explore how areas of musculoskeletal pain would affect the physical capacity among the elderly. It was hypothesised that the TUG category would not have significant effect on 5XSST, that the recreational status would not influence the TUG rating, and that musculoskeletal pain areas would not affect the physical capacity of the elderly.

## Subjects and Methods

The descriptive, cross-sectional study was conducted between October 2018 and April 2019 at the College of Medical Rehabilitation Sciences (CMRS), Taibah University, Madina, Kingdom of Saudi Arabia (KSA). After approval from the institutional ethics review committee, the sample size was determined using G*power[16] version 3 based on power 0.8, alpha ()α error 0.05 and medium effect size 0.4 for F tests analysis while opting for analysis of variance (ANOVA) fixed effects, omnibus, one-way statistical test. The sample was raised consecutively using purposive sampling technique from the central area of Madina, which is KSA's Western province.

Those included were community-ambulant overweight or obese retired individuals of either gender aged 60-69 years. Participants had to indicate symptoms of musculoskeletal pain in the lower limbs or spine or both, but had to be community-ambulant. Those with recent injury, having acute pain or having significant limitation of mobility were excluded and so were those not willing to participate. During initial assessment, the individuals were classified as recreationally active if they reported engagement of moderate-intensity aerobic activity for 150 minutes per week, and as recreationally inactive if they did not meet the threshold set by the American Academy of Sports Medicine (AASM).[9]

After taking informed consent from all the subjects, a template was used to systematically collect data, including age, body mass index (BMI), musculoskeletal pain, and recreational status. With respect to musculoskeletal pain, the subjects were classified into group 1 who indicated pain in the lower limbs, group 2 who indicated pain in the spine, and group 3 who indicated pain both in the lower limbs and the spine. Pain body diagram and numeric pain intensity scale were used to identify the site and severity of pain, respectively. All the subjects performed TUG and 5XSST as well as SLST on both the right and the left legs.

For TUG, the subjects were instructed to sit in the standard chair with their back to the chair and arms resting on the arm-rests. They were then asked to stand up and walk a 10 feet (3 metres), turn around and walk back to the chair and sit down again. They were instructed to walk at a comfortable pace to the line that was 3 metres from the chair. The line was marked with a tape. Timing began once the subject started to rise from the chair and ended when they returned to the chair and sat down. One practice trial was given before the actual measurement. The time was recorded in seconds using stopwatch, and the tester recorded the average of two attempts. The subjects were allowed to rest as long as needed between the attempts, and were allowed to wear the usual footwear and use the normally-used assistive device. TUG categories were defined as freely mobile, mostly independent and variable mobility. Used to measure mobility, TUG is a functional test and clinicians use it as part of routine clinical examination.[13,15]

For 5XSST -stand, the subjects were instructed to sit in a standard-height chair (43-47cm) with back against the chair, cross the arms on the chest for the entire test and put the feet comfortably on the floor. They were asked to stand up and sit down five times as quickly and safely as possible once they heard the word "Go". It was ensured that every subject stood up completely to erect standing position. Timing was recorded in seconds using stopwatch, beginning at "Go" and ending when the elderly had completed the 5th posture. One practice trial was given before the actual measurement and for only one transition to avoid fatigue. The 5XSST was used to measure functional lower-limb strength, transitional movements and balance.[17]

For SLST, the subjects were instructed to stand erect bare-footed with arms folded across the chest, eyes open and the head facing straight ahead. They were asked to raise one leg and keep it raised as long as possible without touching the other leg, without uncrossing the arms, or seeking any support for balance. The balance time was recorded in seconds using stopwatch. Timing started once the foot was lifted off the floor and stopped when the subject reached out for any kind of support or uncrossed the arms.[18] The order of outcome measurements was kept random to avoid any order effect as a threat to internal validity.[19,20]

Data was analysed using SPSS 23. Statistical significance was set at alpha level of ≤0.05 with 95% confidence interval (CI) of the difference. The subjects' characteristics were reported as frequencies and percentages, while descriptive data for all the variables was reported as mean±standard deviation (SD) and median along with interquartile range

(IQR). Shapiro-Wilk test was used to evaluate normality of data distribution. Independent samples Kruskal-Wallis H test was used to detect differences between TUG categories and musculoskeletal pain areas. Independent samples Mann-Whitney U test was run to detect differences between gender and recreational status. Related-samples Wilcoxon signed rank test was run to examine SLST outcomes related to the right and the left legs. Spearman's rho test was run to determine the agreement between all the related variables when non-parametric inferential statistics were needed.

## Results

Of the 150 subjects, 108(72%) were males and 42(28%) were females. The overall mean age was 63.1±2.5 years and the mean BMI was 29.6±3.8 kg/m$^2$. There were 46(31.5%) subjects who were freely mobile, 60(41.1%) were mostly independent and 40(27.4%) had variable mobility. Also, 36(24%) subjects were recreationally active, while 114(76%) were recreationally inactive (Table 1).

**Table-1:** Demographic data. (n=150).

| Parameter | Mean±SD | Range |
|---|---|---|
| Age (years) | 63.1±2.5 | 60-69 |
| Height | 1.7±0.08 | 1.4-1.8 |
| Weight | 81.6±10.2 | 60-110 |
| BMI | 29.6±3.9 | 25.0-42.9 |
| **Parameter** | **Median** | **IQ Range** |
| Timed Up& Go | 14 | 10-22 |
| Five times sit to stand | 19 | 15-28.3 |
| Rt Single Leg Standing | 10 | 5-16.3 |
| Lt Single Leg Standing | 10 | 5-17 |
| Characteristics | N | % |
| **Gender** | | |
| Male | 108 | 72% |
| Female | 42 | 28% |
| **BMI** | | |
| Overweight | 87 | 58.2% |
| Obese | 63 | 42% |
| **Recreationally active** | | |
| Yes | 36 | 24% |
| No | 114 | 76% |
| **Musculoskeletal Pain** | | |
| Pain at lower limbs | 42 | 28% |
| Pain at spine | 82 | 54.7% |
| Pain at lower limbs& Spine | 22 | 14.7% |
| **Timed Up&Go Category** | | |
| Freely Mobile | 46 | 31.5% |
| Mostly Independent | 60 | 41.1% |
| Variable Mobility | 40 | 27.4% |
| **Five times sit to stand** | | |
| Normal | 14 | 9.3% |
| Abnormal | 136 | 90.7% |

N: Number; SD: Standard deviation; BMI: Body mass index; IQ: Interquartile.

**Table-2:** Test results related to TUG category and musculoskeletal pain.

| | TUG Median (IQ Range) | 5x sit to stand Median (IQ Range) | Rt SLS Median (IQ Range) | Lt SLS Median (IQ Range) |
|---|---|---|---|---|
| **TUG Category** | | | | |
| Freely Mobile | 9 | 14 | 9 | 13 |
| | (9-10) | (122-18) | (5-17) | (7-21) |
| Mostly | 14* | 19* | 11 | 10 |
| Independent | (13-16) | (16-23) | (4.5-17.5) | (5-17) |
| Variable | 32 | 38 | 9 | 9 |
| Mobility | (25-50) | (24-55) | (5-16) | (5-13) |
| **Musculoskeletal Pain** | | | | |
| Pain at lower | 13 | 19 | 10 | 10 |
| limbs | (10-16) | (14.8-23.3) | (5.8-16) | (7-16.3) |
| Pain at spine | 14 | 18 | 10 | 11.5 |
| | (10-25) | (14.8-33) | (5-17.5) | (5-19.5) |
| Pain at lower | 15 | 18 | 9.5 | 9.5 |
| limbs& spine | (10.8-25.8) | (16-25.3) | (4.8-15) | (4.8-12.5) |

IQ: Interquartile; TUG: Timed Upand Go; SLS: Single-leg stance; * significance $p<0.05$.

**Table-3:** Test results related to gender and recreational status.

| | TUG Median (IQ Range) | 5x sit to stand Median (IQ Range) | Rt SLS Median (IQ Range) | Lt SLS Median (IQ Range) |
|---|---|---|---|---|
| **Gender** | | | | |
| Male | 14 | 19 | 10 | 12 |
| | (10-22.8) | (15-28.8) | (7-17) | (6-17) |
| Female | 14 | 18 | 5* | 8* |
| | (10.8-22.5) | (15-28) | (4-15) | (4-13.3) |
| **Recreational status** | | | | |
| Active | 12 | 19 | 10 | 12 |
| | (9-15.8) | (14-22) | (5-16.8) | (8.3-18.5) |
| Inactive | 15* | 18.5 | 9.5 | 9.5 |
| | (10-25.3) | (15-33.3) | (5-16.3) | (5-16.3) |

IQ: Interquartile range; TUG: Timed Up and Go; SLS: Single-leg stance; * significance $p<0.05$

TUG categories showed significant difference ($p$=0.00) related to 5XSST results (Table 2). Regarding musculoskeletal pain areas, there was no significant difference ($p>0.05$) for all outcome measures. Gender showed significant difference for SLST on the right leg ($p$=0.01) and the left leg ($p$=0.04), but not for TUG and 5XSST. Male subjects stood longer on one leg than the females ($p<0.05$). There was significant difference ($p$=0.007) being recreationally active or inactive status for TUG, but not for the rest of the outcome ($p>0.05$). Recreationally active subjects took less time to finish TUG than the inactive subjects (Table 3).

With respect to SLST outcome on the right and the left legs, there was no significant difference (p=0.69). Standing time on the right leg was not significantly different from that on the left leg ($p>0.05$). There was moderate positive correlation ($p<0.001$) as the subjects who balanced for longer on the right leg tended to balance longer on the left

leg as well. Also, a moderate positive correlation was found ($p<0.001$) between TUG and 5XSST outcomes, with those who managed to transit from sit to stand in less time also managing to finish TUG in less time.

## Discussion

The current study showed significant difference in the outcome measures of 5XSST with less time for the freely mobile TUG category compared to the other categories. Recreationally active individuals demonstrated less time to finish TUG compared to the recreationally inactive. Musculoskeletal pain areas did not seem to significantly affect any outcome measure. Male subjects took longer time to balance on one leg during SLST compared to the females.

Regarding the 5XSST outcome, the freely mobile group managed to finish the task in significantly less time, which is in agreement with the nature of TUG test in which the elderly have to execute the sub-tasks of sit-to-stand and stand-to-sit from a standard chair.[13] The 5XSST assesses the transitional movements, lower limbs strength and balance, which are essential for successful performance of the timed up and go. Also, TUG and 5XSST had moderate positive association since both seemed to measure the same attribute. The findings concur with those reported earlier.[14] Makizako et al.[17] mentioned that the poor performance in either TUG or 5XSST is a good predictor for the possibility of developing disability in elderly individuals, and determined the cut-off point for TUG and 5XSST to be equal to or greater than 9 seconds and 10 seconds, respectively. The cut-off points determined by Makizako et al.[17] are in harmony with the cut-off points used in most research work. Kang et al.[12] evaluated the accuracy of TUG test to screen for risk of falls among community-dwelling elderly individuals. TUG test was a predictive tool for recurrent falling and 15.96 seconds was determined to be the cut-point for recurrent falls in elderly Chinese individuals.[12]

Recreational status plays a vital role in keeping elder individuals mobile and independent. Kim and Lee[3] studied the association between sedentary behaviour and the HRQOL on a sample of 1,415 subjects aged >65 years. Results showed that the young-old spent 7.7 hours in sedentary pursuit. The longer the sitting time adopted per day, the lower was QOL. Researchers encouraged the elderly to reduce the sedentary behaviour and engage in more activities to promote physical independence for better HRQOL.[21] Overweight/obesity, being recreationally inactive and suffering from musculoskeletal pain are real challenges, especially among the elderly. Therefore, healthcare professionals have to make sure that the physical capacity of the elderly is exceeding their work demand in order to enjoy successful physical-functional independence.[22,23] Batsis et al.[10] studied the elderly aged ≥60 years to investigate the effect of obesity on functional abilities. They collected data on physical limitations and basic activities of daily living, and found that obesity was associated with higher physical impairment, especially among the females. Many researchers have investigated the interactions between the levels of physical activity, overweight/obesity and musculoskeletal disorders among older adults. Alrushud et al.[24] investigated the effect of physical activity on musculoskeletal function on a sample of older adults who were overweight/obese and suffered from knee osteoarthritis, concluding that the quality of evidence and benefit of interventions were unclear.

The presence of one, two or three areas of musculoskeletal pain did not significantly affect the outcome measures in the current study. The findings agree with earlier results.[7] A study[8] confirmed the findings of expecting worse performance even with single risk factor. The inadequacy of physical activities related to age, behaviour and occupation seem to limit the physical capacity. In addition, the sole presence of any musculoskeletal pain was enough to limit the physical capacity of the elderly, but the presence of more areas was not significantly affecting the physical capacity. Studies have frequently accentuated the role of early intervention to address any physical limitation before developing any diseases and controlling any risk factors to keep the elderly mobile and independent as long as possible. Physical independence of the elderly is not only in their own best interest, but for the society at large.[1,9,21,23]

The poor performance among females on SLST could be explained by the decreased physical fitness since females tend to be less active, making their physical capacity less effective and less efficient.[9,25] Moreover, the prevalence of obesity was more among the females which constitutes another physical challenge.[6] Furthermore, frailty tends to affect older-age women with increasing chance of falling and adverse health outcomes.[26]

The current study assessed the performance of community-dwelling individuals, and identified elements that independently predicted recurrent falls. The duration of >15 seconds to finish the 5XSST had moderate risk which doubled the risk of falls. In essence, healthcare authorities should implement viable evidence-based prevention and health promotion programmes that are easily accessible and sustainable to assure the functional independence of the elderly for as long as possible. It is recommended that more female participants and older-age strata should be included in future studies to better understand the aging effect on the outcome measures. Also, dynamic balance

skills must be assessed and correlated with static balance skills and other outcome measures to explore its association with the risk of falls.

## Conclusion

The elderly belonging to different TUG mobility categories demonstrated variable 5XSST abilities, but it did not seem to influence SLST abilities. Recreational status also significantly affected the mobility category.

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**Conflict of interest:** None.

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