Influence of stretching and strengthening exercise on functional activity in Genu Osteoarthritis patients

Fadillah Nur Syamsia¹, Djoham Aras¹, Yusfina¹
¹Physiotherapy Study Program, Faculty of Medicine, Hasanuddin University, Makassar

fadillahanhar1@gmail.com

Abstract. Genu osteoarthritis is a chronic degenerative joint disease in the cartilage of knee marked by clinical, histological, and radiological changes. In genu osteoarthritis, patients will experience morning stiffness, pain and joint inflammation, range of motion limitation, decreasing of muscle power, joint instability and functional activity disorders. Stretching and strengthening exercises are two techniques that can be used to increase functional activity for patients with osteoarthritis genu. This study aims to determine the different of functional activity in patient with osteoarthritis genu before and after stretching and strengthening exercise. This study was used quasi experimental research method with one group pretest-posttest time series design. The sampling technique was purposive sampling with the number of samples as many as 25 people who met the inclusion criteria such as aged ≥ 40 years, had a Manual Muscle Test value ≥ 3, had contracture of flexor muscle of knee and followed all of the study procedure. The measuring instruments was Western Ontario and McMaster Universities Osteoarthritis Index to determine the functional activity before and after 3 and 6 times of therapy. The data was analysed by paired T test. The results showed that there were an increasing activity of daily living in patient with osteoarthritis genu after 3 times treatment (p=0,001) and 6 times treatment (p=0,001) stretching and strengthening exercise both in woman and man.

1. Introduction
Osteoarthritis (OA) had affected 70% of women and 60% men aged more than 70 years old [1]. OA was representing the global health problem which covered 8-15% of total population [2]. The prevalence of OA was associated to aging process which affects 13.9% of adults aged 25 years and older and 33.6% of elderly adults aged over than 65 years [3]. Meanwhile, a population-based cohort study in England found prevalence among knee or hip OS patients was higher than general population [4].

OA is a degenerative joint disease which represented with pain, functional disorder and disability that experienced among elderly adult [2,3,5,6]. OA is most disabling form of joint disease which more common than rheumatoid arthritis (RA) and other joint disease [7]. In Indonesia, osteoarthritis prevalence is 5% among adult aged less than 40 years old, 30% of adults aged between 30 years and 60 years and 65% of elderly adult aged more than 61 years. Most frequent osteoarthritis are knee joints. Approximately, 80% of osteoarthritis among elderly adult aged 60 years suffered knee joints and estimation 1-2 million elderly adult with disabilities due to osteoarthritis.
Older adult with OA might be less competent compared to older adult without OA and facing more difficulties in outdoor physical activities which leads to poor life quality [8]. In addition, smoking and obesity also influence on osteoarthritis. The genu osteoarthritis occurs such as morning stiffness, inflammation and joint pain, muscle weakness, deformity and walking style changes. The muscle weakness leads to functional disruption in genu osteoarthritis patients such as standing, walking up and down stairs, sitting, squatting and other activities requiring the knee loading. The decrease running capabilities causes interruptions in the running phase such as loss in running phase.

In addition, strengthening exercise isometric is dynamic exercise by muscle contraction provided external resistance with fast movement, loads are provided throughout the joint scope. The strengthening exercise with resistance can improve physiological changes and daily activity among osteoarthritis patients. Based on the preliminary study showed 30 osteoarthritis patients seek the treatment at Physio Sakti clinic and Asy-Syifa Makassar and some OA patients had suffered muscle weakness which need stretching and strengthening exercise. This study aims to determine the different of functional activity in patient with osteoarthritis genu before and after stretching and strengthening exercise.

2. Methodology

This study was used quasi experimental with one group pretest-posttest time series design. The study was conducted at Physio Sakti clinic and Asy-Syifa Makassar on 6th April until 29th April 2017. The study population was all genu osteoarthritis patients who have medical check-up in Physio Sakti clinic and Asy-Syifa Makassar with total of 30 patients. The samples were 25 patients which met the inclusion criteria such as aged ≥ 40 years, had a Manual Muscle Test value ≥ 3, had contracture of flexor muscle of knee and followed all study procedure.

The data was collected by using Western Ontario and McMaster Universities Osteoarthritis Index to determine the limitation of functional activity. Measurement data for functional activity difficulty, muscle strength, waist circumference and leg length were obtained by direct measurement. In pretest, the stretching and strengthening exercise was given three times and six times stretching and strengthening exercises in posttest. The data was analysed using paired T test by SPSS program to determine the difference of functional activity in genu osteoarthritis patients before and after given stretching and strengthening exercise.

3. Result and Discussion

3.1. Result

Table 1 shows that the respondent characteristic distribution included gender, age, employment and waist circumstances. There were 17 respondents (68%) were female and 8 respondents (32%) were male. In addition, 12 respondents (48%) were aged between 61 years old and 70 years old and 2 respondents were aged more than 71 years old. Meanwhile, 11 respondents were housewives and only 1 respondent was lecturer. Besides, 8 respondents (32%) were self-employed and 2 respondents were civil servant. For waist circumstances, 10 female respondents (16%) had more than 80cm waist circumstances and 7 female respondents (16%) had less than 80cm waist circumstance. In addition, 4 respondents (10%) had more than 90 cm waist circumstances and 4 male respondents (7%) had less than 90 cm waist circumstances.

| Characteristic       | n  | %  |
|----------------------|----|----|
| Gender               |    |    |
| Female               | 17 | 68 |
| Male                 | 8  | 32 |
| Age (years old)      |    |    |
There were 4 respondents (23.5%) had medium functional activity difficulty and 10 respondents had difficulty in functional activity during the pretest for female. Meanwhile, 13 respondents (76.5%) had medium functional activity difficulty and only 1 respondent claimed easy in functional activity during 3 times of stretching and strengthening exercise. In additions, 15 respondents (88.2%) claimed easy in functional activity and 2 respondents (11.8%) had medium functional activity difficulty during six times of stretching and strengthening exercises.

Meanwhile, 5 male respondents (12.5%) claimed functional activity was very difficult and only 1 male respondent had medium in functional activity difficulty during pretest. Furthermore, 5 respondents (62.5%) had faced difficulty in functional activity and only 1 respondent (12.5%) claimed easy in functional activity on three time of stretching and strengthening exercise. There were 4 respondents (50%) had medium in functional activity difficulty and 3 respondents claimed getting easier in functional activity after 6 times of stretching and strengthening exercise.

Table 2. Distribution of functional activity of genu osteoarthritis patients on pretest, after given 3 times and 6 times of stretching and strengthening exercise based on gender.
For male, the mean of pretest and posttest of six times of stretching and strengthening exercise were 49.75 and 19.25 on functional activity. Meanwhile, mean of pretest and posttest of six times of stretching and strengthening exercises for female were 41.00 and 13.59 on functional activity.

In additions, pretest and posttest of three times mean on manual muscle test were 3.25 and 4.25 for male. Meanwhile, mean of posttest of three times and six times for female were 3.76 and 4.82 on manual muscle test.

The leg length test found male had score high mean on posttest of six times was 90.38 and female had high mean value on post-test of six times which was 84.88. The paired T test found there was significant relationship between pretest and posttest of three times of stretching and strengthening exercise, p=0.001<0.05. Besides, there also significant relationship between pretest and posttest of six time of stretching and strengthening exercise. Therefore, there was difference in functional activity after the stretching and strengthening exercise in genu osteoarthritis patients regardless gender in form of functional activity increment.

Table 3. Data analysis of pretest and posttest on 3 times and 6 times of functional activity

| Variable              | Male                | Female              | Sig*   |
|-----------------------|---------------------|---------------------|--------|
|                       | Mean±SD             | Mean±SD             |        |
| Functional activity   |                     |                     |        |
| Pretest               | 49.75±8.498         | 41.00±9.624         | 0.001  |
| Posttest 3x           | 32.00±7.783         | 26.12±5.732         |        |
| Pretest               | 49.75±8.498         | 41.00±9.624         |        |
| Posttest 6x           | 19.25±9.285         | 13.59±5.129         |        |
| Manual muscle test    |                     |                     |        |
| Pretest               | 3.25±0.463          | 3.12±0.332          |        |
| Posttest 3x           | 4.25±0.463          | 3.76±0.437          |        |
| Posttest 6x           | 4.88±0.354          | 4.82±0.393          |        |
| Leg length test       |                     |                     |        |
| Pretest               | 65.75±1.753         | 64.24±25.38         |        |
| Posttest 3x           | 76.13±3.482         | 73.35±1.998         |        |
| Posttest 6x           | 90.38±6.278         | 84.88±6.421         |        |

3.2. Discussion
The result showed there was an increase in functional activity in genu osteoarthritis patients after given three times (p=0.001) and six times (p=0.001) of stretching and strengthening exercise in women and men. Nguyen et al. (2016) stated the strength exercise had greatest improvement for pain, disability, physical function, stiffness and motion range within 8 weeks to 24 weeks [9]. Smidt et al. (2005) mentioned exercise therapy such as stretching, strengthening and functional exercises is helpful for knee and hip osteoarthritis patients compared patients with no treatment [10].
The continuous strengthening exercise provide an adaption effect to the muscle contractions which greater the stimulation. More muscle contraction based on the intensity given lead more active on motor and better in muscle strength. Regular strengthening exercise cause muscle hypertrophy caused by increment in myofibril amount and size, capillary blood vessel density, tendon nerve and ligament and total contractile in myosin protein which increases proportionally.

The changes in muscle fiber did not occurs in same rate, increases in white muscle fibers (fast twitch) resulting in increases muscle contraction speed. The muscle strength is also caused by changes in muscle biochemistry such as increased creatine phosphate concentration and adaption existence of nervous system to support patients to perform activities related to the joint function such as stand, squat or walk. The daily life activities requires good muscle strength, muscle endurance, muscle flexibility and joint motion scopes due to muscle contraction or due to coincidence in the joint.

Besides, stretching exercise also increase the functional activity because stretching stimulated inverse stretch or autogenic inhibitions and adjust to Sherrington’s law if the muscle get the stimulation for contraction. The important receptor in the inverse stretch reflex is Golgi tendons organ. Thus, a strong muscle contraction of knee flexion will stimulate the agonist muscle so that the impulse goes to the spinal column medulla precisely on the interneuron inhibitor which produces the inhibitory response to the muscles through the motor nerve fibers resulting in the contraction that occurs with relaxed muscle.

In additions, stretching had reciprocal inhibition principle which there is synaptic post inhibition. Meanwhile, stretching increased blood flow and carried nutrients to the muscle and discharges waste of metabolism from the muscle and accelerate the muscle injury recovery. The muscle flexibility helps genu OA patients can perform daily activities without any motion limitations.

4. Conclusion
In conclusion, there was difference in functional activity in genu osteoarthritis patients after given stretching and strengthening exercise. Meanwhile, six times of stretching and strengthening exercise was more effective than three times of exercise to enhance the functional activity.

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