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PHYSICAL ACTIVITY FOR OSTEOARTHRITIS: A CROSS SECTIONAL STUDY

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Background. Physical activity is a fundamental and proactive form of conservative treatment for persons with knee osteoarthritis.

Study purpose. This study aims to investigate risk variables for individuals in Indonesia who had knee osteoarthritis (OA).

Materials and methods. This study's cross-sectional study design employed an observational analytical approach. The samples obtained using Slovin's formula contained as many as 66 respondents. The study's dependent variables were the primary and secondary types of knee OA.

Results. The study's dependent variables were the primary and secondary forms of knee OA. 43 patients experienced the primary knee OA, while 23 experienced the secondary OA. The logistic regression test used age (p=0.011), gender (p=0.021), body mass index (p=0.027), history of knee injury (p=0.001), hypertension (p=0.023), hypercholesterolemia (p=0.112), and physical activity (p=0.004) as independent variables. These variables also met the criteria to be incorporated into the multivariate analysis with a p value less than 0.25. The biggest risk factor for knee OA was found to be age (OR=1.923; p=0.011; p=0.011). Knee OA is significantly influenced by age, gender, BMI, a history of knee injuries, and physical activity.

Conclusions. Increased physical activity is necessary for those with knee osteoarthritis. Patients with knee osteoarthritis should be treated by healthcare professionals who are aware of their physical activity habits, especially those at risk.

Keywords: osteoarthritis, physical activity, rehabilitation, pain.

Introduction

A chronic degenerative joint condition that affects the articular cartilage is osteoarthritis (OA). Because of the constant pressure over many years, this condition, which is directly associated to aging, is most commonly found in the joints of the knees, hips, fingers, and lumbar vertebrae (Kesehatan et al., 2019).

According to WHO data, there are 9.6% more males than women with OA than are over 60 years old (Charlesworth et al., 2019). In patients aged 40 to 60 years in Indonesia, the prevalence of knee OA is established by radiological examination and is 15.5% in males and 12.7% in women (Kesehatan et al., 2019). An average prevalence of joint illness of 24.7% was determined by Indonesian Basic Health Research (Riskesdas) data in 2019 from respondent interviews with a sample of 722,329 people aged 15 from each province in Indonesia. Around 27% of the population in East Java Province suffers from OA, which is a rather significant prevalence (Kesehatan et al., 2019).

Although the exact etiology of OA is unknown, a number of risk factors can lead to the disease. You can divide these risk factors into non-modifiable and modifiable categories. Age, gender, physical disability/body imbalance, trauma history, and ethnicity are risk factors that cannot be changed. Osteoarthritis typically affects elderly people and is more prevalent in women (Derwich et al., 2020). Body mass index (BMI), diabetes, hypercholesterolemia, hypertension, and smoking are the risk factors that can be changed. Review articles on obesity and osteoarthritis by Bestwick-Stevenson et al. (2021) came to the conclusion that obesity is a modifiable risk factor that has the strongest correlation with the development of knee OA.

The World Health Organization (WHO) claims that both industrialized and developing nations are susceptible to the impairment caused by OA. Knee and hip osteoarthritis is the 11th most prevalent form of disability worldwide (Choi et al., 2019). One of the causes of disability is mechanical and chemical injury, which is one of the etiologies for defective cartilage metabolism and damage to proteoglycans. An key contributor to joint inflammation, chondrocyte destruction, and pain is assumed to be mechanical and chemical insult, which induces the development of aberrant molecules and cartilage breakdown products in the synovial fluid of the joint (Abramoff & Caldera, 2020). Patients with knee OA will have continuous and escalating discomfort near the knee joint. If you engage in knee-taxing activities like walking, climbing and descending stairs, or prolonged standing, the discomfort will worsen. These conditions range in severity from minor to so severe that the sufferer is unable to walk (Zeng et al., 2021). In order to lessen pain, patients with knee OA will restrict knee joint mobility. Long-term immobilization of the knee joint muscles causes weakening and even atrophy. This will affect the victim's socioeconomic circumstances (Whittaker et al., 2021).

The results of the history, physical examination, and radiographic examination are used to make the diagnosis of osteoarthritis. Patients with osteoarthritis of the knee typically report long-standing pain complaints, but the condition progresses slowly (Ghouri & Conaghan, 2021). Physical examination revealed that the knee joint had little range of motion. An osteophyte picture in the knee joint was found aberrant during a radiological evaluation using an X-ray of the knee joint. However, joint radiographs taken early in the disease are frequently normal (Blanco et al., 2021).

Joint function has not been able to return to normal following pharmacological treatment for OA. Non-steroidal anti-inflammatory medicines (NSAIDs), for example, are used in pharmacological therapy to alleviate OA symptoms such pain and swelling (Astephen Wilson & Kobsar, 2021). Additionally, hyaluronic acid molecules used in intra-articular injection therapy only served to improve the suppleness and viscosity of joints rather than changing illness (Boer et al., 2021). Intra-articular injections and the use of NSAIDs have not yet significantly improved outcomes. Surgery is another option for treatment, although the outcomes are also unsatisfactory. Surgery can only effectively reduce discomfort; it cannot significantly enhance joint function (Cao et al., 2021). Therefore, a primary goal in reducing disability from OA is the recognition of risk factors in attempts to prevent OA. According to studies on 30 people with knee osteoarthritis in Yogyakarta, it is possible to significantly slow the course of knee OA by decreasing weight, performing regular knee exercises, and taking medication on a regular basis (Rohmansyah et al., 2021). The purpose of this study was to investigation risk factors for patients in Indonesia with osteoarthritis (OA) of the knee joint will be analyzed.

Materials and methods

Design

Analytic observational methodology and a cross-sectional design were employed in this study. This study was carried out in the provincial hospital's orthopedic polyclinic, medical records department, and each respondent's residence.

Study participants

There were 127 individuals with knee osteoarthritis who received care at provincial hospitals in the most recent six months, from 1 December 2018 to 30 May 2019. All OA patients who met the inclusion criteria and gave their informed agreement to participate in the study made up the sample for this investigation. Patients with knee osteoarthritis in a provincial hospital who agreed to participate in the trial were the only inclusion criteria.

Patients with osteoarthritis affecting joints other than the knee, gout, rheumatoid arthritis, systemic lupus erythematosus (SLE), and rheumatic fever, patients with a history of patellar fractures, femur fractures, and tibia fractures, and patients with incomplete medical records were all excluded from this study. The Slovin algorithm was used to determine the sample size (Arikunto, 2017), yielding 56 responses.

$n=N/(1+Ne^2)$

Information:

N: number of samples

n: total population

e: fault tolerance limit

Measurement

Blood sugar and cholesterol levels

If the respondent doesn't know their blood sugar and cholesterol history, the technique of measuring those values will be used. Sitting down, respondents underwent a physical examination. Install a glucose or cholesterol chip and prepare the tool in an ignitable state. In the lancet pen, get a sterile needle ready. Aseptic protocols should be followed on the region where the droplets will be collected and an alcohol swab should be prepared. In the ring or middle finger's palm, place the pen lancet. The examiner uses the examination chip to take blood samples from the respondent and measure their cholesterol and blood sugar levels. A single exam will be used to measure both cholesterol and blood sugar levels. Milligrams per deciliter of blood (mg/dl) are the units used to measure blood sugar and cholesterol levels.

Physical activity assessment

A Baecke physical activity questionnaire was used in this interview-based study. The physical activity questionnaire is broken down into three categories: activities done while at work or connected to work, activities done in free time or away from work, and activities done while participating in sports. The findings of the assessment of physical activity can be divided into three levels, namely low, moderate, and heavy activities, based on the Baecke index score (Sadeghisani et al., 2016), mild activity (score 5.6), such as sweeping the floor, washing the dishes or clothing, sitting and watching television, usually involves little effort and has no noticeable effects on respiration or endurance. Moderate exercise (score 5.6-7.9) that calls for sustained or intensive effort as well as flexible muscular action, such as jogging, table tennis, swimming, cycling, and brisk walking. Running, playing soccer, doing

aerobics, and self-defense are examples of strenuous activity (score > 7.9) that typically relates to sports and calls for strength and perspiration (Sadeghisani et al., 2016).

Statistical analysis

Using the Excel 2020 application, data were gathered and processed. Univariate and bivariate analyses of the data were performed. Descriptive statistics are used in univariate analysis to identify the sample identification (age, gender, occupation), body mass index (BMI), history of disease or injury, smoking habits, and physical activity, as well as other aspects of the data. Due to the fact that the data utilized in this study are nominal data with non-parametric statistics and a significance threshold of $p<0.05$, bivariate analysis is employed to determine the relationship between the dependent variable and the independent variable. Because the used dependent variable was dichotomous/had two categories, the independent variables were not interval or ratio data, and they were not regularly distributed/non-parametric statistics, multivariate testing using logistic regression was performed to determine the most significant variable. Utilizing statistical analysis software throughout the entire data processing and analysis process.

Results

Primary and secondary osteoarthritis of the knee are the two classifications. 43 primary OA and 23 secondary OA were found in the study's 66 samples of knee OA. With a sample size of 51 patients, the age group with the highest prevalence of knee OA was 41–61, whereas the group with the lowest prevalence was 21–40, represented by 15 patients. There were 17 patients with male sexual orientation and 49 patients with female sexual orientation.

The majority of patients with knee OA, or 23 individuals, work as housewives. The remaining patients are traders, laborers/farmers, public servants, retirees, and entrepreneurs.

With 28 patients, the overweight category (BMI 25–29.9 kg/m2) had the highest BMI. In contrast, 8 patients fell into the underweight BMI category (18.5 kg/m^2), which had the lowest percentage. 18 patients in 66 samples of osteoarthritis patients had a history of knee injury, while 48 patients had no such history. There were 10 patients with OA in their families and 56 individuals without OA in their families.

In 29 patients with knee OA, hypertension and a history of hypertension were present. While there were 47 patients who had no history of hypertension. 53 patients had no history of diabetes, compared to 13 patients who both had diabetes and that history. Thirteen patients had both hypercholesterolemia and a history of it, compared to 53 patients who had no such history. In the non-smoking category, 42 patients had the greatest smoking habit. The examination of the level of physical activity revealed that there are 33 persons who engage in moderate physical activity, 26 who engage in severe physical activity, and 7 who engage in light physical activity.

The independent variables used in the logistic regression test were age ($p = 0.011$), gender ($p = 0.021$), body mass index ($p = 0.027$), history of knee injury ($p = 0.001$), hypertension ($p = 0.023$), hypercholesterolemia ($p = 0.112$), and physical activity ($p = 0.004$). These variables also met the criteria to be included in the multivariate analysis with a p value of less than 0.25.

Table 1. Risk factor for OA

Variable	OA primary	OA secondary	p value
Age			
21-30	2	5	0.021
31-40	3	5	
41-50	10	2	
50-60	14	8	
61 and above	14	3	
Gender			
Women	35	14	0.011
Man	8	9	
BMI			
Underweight	3	5	0.034
Normal	6	8	
Overweight	20	8	
Obesity	18	7	
History of knee injury			
Yes	7	11	0.001
Not	37	11	
Physical Activity			
Light activity	4	3	0.005
Moderate activity	16	17	
Strenuous activity	22	4	
Family history of OA			
Yes	6	4	0.635
Not	36	20	
Hypertension			
Yes	20	9	0.312
Not	28	19	
DM			
Yes	9	4	0.247
Not	34	20	
Hypercholesterolemia			
Yes	9	4	0.113
Not	36	21	
Smoking habit			
Do not smoke	31	11	0.412
Light smoker	2	3	
Medium smoker	6	6	
Heavy smoker	4	5	
Work			
Trader	9	4	0.284
Farm workers	11	7	
Civil Apparatus	2	1	
Retired	1	2	
Self-employed	3	4	
Housewife	17	5	

Table 2. All variables are entered into the model

Variable	p value	OR
Age	0.011*	1.923
Gender	0.023*	1.136
BMI	0.023*	1.952
History of knee injury	0.001*	0.042
Physical activity	0.004*	3.729
History of OA	0.673	0.032
Hypertension	0.214*	0.783
Diabetes mellitus	0.238*	1.054
Hypercholesterolemia	0.112*	1.832
Smoking habits	0.424	3.837
Occupation	0.372	3.657

Discussion

Age and knee OA were shown to be significantly correlated in this study (p = 0.005). The percentage of women with OA rises with age, according to research by Nelligan et al. (2019) among 422 women aged 30 to 60. Age was discovered to be strongly related to knee OA (Ghouri & Conaghan, 2021).

Osteoarthritis is a degenerative joint condition that affects the elderly in particular. When a person reaches age 45, they are considered old (Kesehatan et al., 2019). Age-related changes in collagen and a decline in the production of proteoglycans make bones and joints less elastic and more prone to damage (Abramoff & Caldera, 2020). Age-related hormonal changes raise the risk of knee OA, particularly in women following menopause. This implies that hormones play a role in the etiology of OA (Dantas et al., 2021).

According to the study's findings, there is a statistically significant link between gender and knee OA (p = 0.021). Studies showed that women had a noticeably higher incidence of knee OA (Aubourg et al., 2022). As they approach menopause, older women will see a decline in estrogen levels as well as other bodily processes. One of the hormone estrogen's tasks is to aid in the production of chondrocytes, or cartilage cells, which are found in the bone matrix. Because chondrocyte synthesis is affected by estrogen hormone levels, the production of collagen and proteoglycans is also affected. Additionally, as a person ages, lysosomal activity increases, which is why OA affects women more frequently than men (Bierma-Zeinstra et al., 2020).

The results of this study revealed a significant association between BMI and knee OA (p=0.027). This is consistent with the findings of Batushansky et al. (2022) who observed that all 65 respondents with knee OA weighed more than their optimal body weight, and the majority were slightly obese or overweight by 20–40% of their body weight. ideal. Degeneration will be accelerated by excess body weight, especially in the joints that support the weight. Half of the body weight is supported by the knee joint when someone is walking. As a result, carrying more weight doubles the load placed on the knee joint while walking, which can lead to knee OA (Batushansky et al., 2022).

A history of knee injuries and knee OA were shown to be significantly correlated in this study (p=0.001). According to a study by Kolasinski et al. (2020) women with knee OA were more likely to have a history of prior knee injuries than women without such a history. This demonstrates that knee trauma or injury is a factor that affects the prevalence of knee OA. Mechanical injury, which is thought to be a significant factor in stimulating the formation of abnormal molecules and cartilage degradation products in the synovial fluid of the joint, can be brought on by knee injuries such as meniscus tears, ligament instability, intra-articular fractures, or joint dislocation. This causes chondrocyte destruction, joint discomfort, and joint inflammation. This causes chondrocyte destruction, joint discomfort, and joint inflammation (Charlier et al., 2019).

Physical activity and knee OA were shown to be significantly correlated in this study (p=0.004). This is consistent with studies by Sun et al. (2019), which found that middle-aged women and men who engage in vigorous physical activity run the risk of injuring their knees and developing osteoarthritis. OA may be exacerbated by excessive body weight and repetitive joint activity. In persons who are predisposed to OA, repeated impact loads can be a site-defining factor and may be linked to the onset and severity of OA (Block et al., 2022).

According to this study, there was no connection between a family history of OA and knee OA (p=0.542). The findings of this study differ from those of O'Neill & Felson's (2018) study, which found that family history of OA significantly affects the incidence of knee OA (OR: 1.78). This might be as a result of the small sample size and population in the study, which was only carried out at one healthcare agency.

According to this study, there was no discernible link between hypertension and knee OA (p = 0.203). The findings of this study differ from those of O'Neill & Felson's (2018) study, which discovered that individuals with OA were more likely to develop hypertension than the general population (40%vs25%). This may be the result of the responders to this study having hypertension that was sufficiently under control to prevent blood vessel constriction. Uncontrolled hypertension causes blood vessel constriction and subchondral ischemia, which, according to Vina & Kwoh (2018), can cause OA. This kind of subchondral ischemia can encourage bone remodeling and hinder the metabolism of nutrition and gas exchange between articular cartilage and bone.

Diabetes mellitus and knee OA were shown to have no meaningful link in this study (p=0.279). This study is consistent with previous research O'Neill & Felson's (2018) the non-diabetic group had a higher prevalence of knee OA, both in men and women, according to a study using a sample of 3428 adults aged 40 to 74. This may be brought on by the fact that just one examination is performed to measure blood glucose levels, and that the test utilized is a random blood glucose assay (GDA), which is not the ideal test for doing so. HbA1C testing is the procedure that provides the best baseline for managing diabetes (Abramoff & Caldera, 2020). Additionally, diabetes respondents did not report having significant hyperglycemia, which can result in consequences such diabetic neuropathy.

According to this study, there is no connection between hypercholesterolemia and knee OA (p=0.107). The findings of the study by Choi et al. (2019) which indicated that only 27.6% of patients with a history of dyslipidemia had knee OA, also found the same conclusion. Choi et al. (2019) claim that an accumulation of cholesterol can lead to a disruption in the metabolism of cholesterol secretion in degenerative articular cells and result in the onset of OA. This is because the respondents' hypercholesterolemia is under good control, preventing an excessive buildup of cholesterol in the cartilage. In the end, there won't be any disruptions to the metabolism of cholesterol excretion in degenerative articular cells, which won't lead to the onset of OA.

The findings demonstrated that smokers had a lower prevalence of OA than non-smokers. According to this study, there was no discernible link between smoking and knee OA (p = 0.304). This may be due to the research participants' failure to boost the body's level of nicotine through cigarette usage. When the body's nicotine levels are low, osteoblasts continue to function correctly in cartilage and levels of carbon monoxide in the arteries rise, preventing damage to cartilage and normal bone resorption and osteoclast activity (Whittaker et al., 2021). Additionally, one study discovered a link between smoking history and knee OA, meaning that smoking among healthy persons without present or prior knee illness increased knee joint cartilage volume and de-

creased cartilage degradation. This is due to the nicotine in cigarettes' ability to stimulate the chondrocytes' metabolism of protein and enhance the production of glycosaminoglycans and collagen, both of which are important for maintaining joint flexibility (Zeng et al., 2021).

Limitations

This study has a number of limitations, including the fact that the variables hypertension, diabetes mellitus, and hypercholesterolemia are only divided into two categories (yes/no), which means that the study is unable to consider how seriously these conditions may affect the dependent variable. The duration, number of cigarettes smoked daily, and kind of cigarette were not assessed by the smoking habit variable, making it difficult to conduct an appropriate study of the association between smoking behavior and knee OA.

Conclusions

Patients with knee osteoarthritis had significantly lower levels of physical fitness than healthy persons, but the study should be replicated with a larger sample size because increasing physical activity is an essential objective for those with knee osteoarthritis. Our findings suggest that interventions to increase physical activity in people with knee osteoarthritis are crucial, especially for those who are older or have comorbid conditions. Clinicians should make it clear to patients that physical activity does not worsen their condition and assist them in finding activities to improve their physical fitness.

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Conflict of interest

The authors declared no potential conflicts of interest.

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ФІЗИЧНА АКТИВНІСТЬ ДЛЯ ТЕРАПІЇ ОСТЕОАРТРИТУ: ПЕРЕХРЕСНЕ ДОСЛІДЖЕННЯ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 2 табл., 27 джерел.

Історія питання. Основним і проактивним видом консервативного лікування хворих на артроз колінного суглоба є фізична активність.

Мета дослідженя. Метою цього дослідження є вивчення змінних ризику для осіб в Індонезії, які мали остеоартрит (ОА) колінного суглоба.

Матеріали та методи. За планом перехресного дослідження в цьому дослідженні використовували спостережний аналітичний підхід. Вибірки, одержані за формулою Словіна, містили 66 респондентів. Залежними змінними в цьому дослідженні були первинний і вторинний типи ОА колінного суглоба.

Результати. Залежними змінними в цьому дослідженні були первинна та вторинна форми ОА колінного суглоба. У 43 пацієнтів спостерігався первинний тип ОА колінного суглоба, а у 23 – вторинний тип ОА. Як незалежні змінні в логістичному регресивному тесті використовували вік (p=0,011), стать (p=0,021), індекс маси тіла (p=0,027), історію травм колінного суглоба (p=0,001), гіпертензію (p=0,023), гіперхолестеринемію (p = 0,112) та фізичну активність (p = 0,004). Ці змінні також відповідали критеріям для включення в багатофакторний аналіз зі значенням p, меншим за 0,25. Установлено, що найбільшим фактором ризику ОА колінного суглоба є вік (відносний ризик=1,923; p=0,011; p=0,011). ОА колінного суглоба значною мірою залежить від віку, статі, ІМТ, історії травм колінного суглоба та фізичної активності.

Висновки. Особам з остеоартритом колінного суглоба необхідна підвищена фізична активність. Пацієнтів з остеоартритом колінного суглоба, особливо тих, хто входить до групи ризику, мають лікувати медичні працівники, яким відомо про їхні звички до фізичної активності.

Ключові слова: остеоартрит, фізична активність, реабілітація, біль.

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