The Correlation Between Intensity of Physical Activity and Uric Acid Level in Gout Arthritis Patients in The Sobo Public Health Care Banyuwangi

Riyan Dwi Prasetyawan[a], Nur Hidayati[b]
[a] *Department of Nursing, Universitas Brawijaya, Malang, Indonesia*
[b] *Department of Nursing, STIKes Banyuwangi,Banyuwangi, Indonesia*
E-mail: riyandwiprasetyawan@gmail.com

ABSTRACT

Introduction

Uric acid is the result of purine metabolism which is found in the body cells. Increasing levels of uric acid can cause pain in the joints. One of the factors that could affect the levels of uric acid is Physical activity. High intensity of physical activity can make uric acid levels increase.

Methods

Research method used observational with cross-sectional. Thirty gout arthritis patients were enrolled to the study. Data collection techniques used GPAQ (Global Physical Activity Questionnaire) for the intensity of physical activity and Easy touch for uric acid levels measurements. Data was analyzed by using Rank-spearman test with 5% significance level.

Results

The majority of respondents had a high physical activity intensity (n=29). According to Rank-Spearman test, ρ count 0,46685 ≥ ρ table 0.364, it was identified that there was a correlation between the physical activity intensity and uric acid levels.

Conclusion

High physical activity intensity will increase the levels of uric acid.

Keywords

Uric Acid; Physical Activity

BACKGROUND

Uric acid is the end result of purine metabolism. purine is one component of nucleic acid found in the nucleus of the body's cells. Everyone has uric acid in his body because in every normal metabolism of purine will produce uric acid. the levels of uric acid contained in our body should not be excessive. Normal uric acid levels are 2.6-6.0 mg / dl for women and 3.5-7.0 mg / dl for men (1). Increased levels of uric acid can cause disruption to the human body such as mild to severe pain. Pain disorder that persists causes daily activities to be hampered (2). Gout can occur at a young age and old age, but generally 30-50 years old are prone to rheumatic diseases. this age is classified as a productive age, most of whom do moderate to severe activities (3). Excessive levels of uric acid (hyperuricemia) mostly cause inflammation in the joints due to the buildup of monosodium urate crystals in the area.

Prevalence of gout in the United States doubled in population over 75 years between 1990 and 1999, from 21 per 1000 to 41 per 1000 (4). In the second study, the prevalence of gout in the UK and Germany between 2000-2005 estimated to be 1.4% (5). In Indonesia research has also been conducted to find the prevalence of hyperuricemia. The prevalence of joint diseases based on a diagnosis of health workers in Indonesia at the age of ≥ 15 years is 11.9% and based on diagnosis or symptoms 24.7%. The highest prevalence at age ≥75 years (33% and 54.8%). among women, was higher at 13.4% compared to men at 10.3%. The highest prevalence of joint disease, namely in East Nusa Tenggara (33.1%), followed in West Java (32.1%), Bali (30%) and East Java (27%) (6). The results of the preliminary study at the Sobo Banyuwangi Health Center on February 4, 2016, revealed that in 2014 there were 496 new visitors with joint pain cases reaching 496 people and 51 old visitors in one year. Whereas in the last year data recapitulation that is in 2015 the number of patients with cases of joint pain has increased 2-fold from the previous year, namely around 444 men and 985 women. The latest data in February 2016 at the Sobo Banyuwangi Health Center found that there were about 51 patients who were examined in the laboratory, the results of examination of uric acid levels from 33 patients showed uric acid levels above 6.0 mg/dl.

Increased uric acid production can be caused by several precipitating factors, including age, gender, genetics, ethnicity, obesity, level of activity, social environment and lifestyle, as well as a high purine diet. Other causes are blood diseases (bone marrow disease, polycythemia), drugs (alcohol, cancer drugs, vitamin B12) and lack of fluid intake (7). Physical activity carried out by humans is closely related to the level of uric acid present in the blood. Some opinions state that strenuous activity can aggravate gout which is characterized by increased levels of uric acid in the blood. Exercise or physical movements will cause an increase in lactic acid levels. increased levels of lactic acid in the blood makes uric acid expenditure decrease so that the content of uric acid in the body increases (2).

Mayers states that lactic acid is formed by the process of glycolysis that occurs in muscles (8). The increased lactic acid in the blood causes a decrease in renal uric acid expenditure. So that uric acid levels in the blood tend to increase. But the increase in lactic acid levels cannot be measured with certainty because we cannot confirm when the body muscles contract anaerobically. People are just aware of this disease after a tremendous pain in the joints. Though this disease does not come suddenly but through a long process. A person who experiences high levels of uric acid (hyperuricemia) that continues and does not receive proper treatment and control, causes various complications such as stone urine, kidney damage, heart disease, nerve damage and inflammation in the joints (9). Late handling can lead to morbidity, disability, decreased quality of life, and increase the economic burden of patients and their families (10).

Efforts to prevent dangerous complications from hyperuricemia or high uric acid levels are by early detection, namely by examining the gout test, which can be done at a health check-up time or when checking a doctor. The higher the level of blood uric acid, the greater the likelihood of damage to the body's organs (7). Treatment of hyperuricemia can be carried out pharmacologically or non-pharmacologically. Pharmacologically, usually by using

antipyretic drugs that are used to reduce uric acid levels. However, antipyretics have many side effects. The most common side effect is a skin reaction. If skin redness arises, the medication must be stopped immediately because the disorder may become more severe. Allergic reactions in the form of fever, chills, leucopenia, eosinophilia, and arthralgia (7). To reduce the risk of gout, it is highly recommended to exercise regularly, but not all types of exercise can be done by gout sufferers. Improper exercise will cause acid calcification conditions in the joints to become worse (11,12). The role of health cadres is also very necessary especially in terms of providing promotive efforts such as counseling on the prevention of hyperuricemia.

Based on the description above, the researchers are interested in knowing the relationship between Physical Activity Intensity and Uric Acid levels in gout patients in the Work Area of Sobo Health Center in Banyuwangi Regency in 2016.

METHOD

The type of research used in this study is observational with a cross-sectional approach, where data collection is at once. This means that each research subject is only observed once and at the same time, the measurement is carried out on the character status, or variable subject at the time of examination (13).

The population used in this study were all gout patients in the Sobo Community Health Center in Banyuwangi Regency in 2016 as many as 33 people. In this study, the sampling technique used is simple random sampling. The independent variable in this study is the intensity of physical activity and the dependent variable in this study is the level of uric acid.

The measuring instrument used in this study is the GPAQ (Global Physical Activity Questionnaire) to measure the intensity of physical activity, and the EASY TOUCH for testing uric acid levels. Parameters of the intensity of Physical Activity are hight: Perform activities that are at least 3 days heavy with a minimum intensity of 1500 MET-minutes / week, or Do a combination of physical activity that is heavy, moderate, and runs for 7 days with a minimum intensity of 3000 MET-minutes / week; Medium: Strong intensity of at least 20 minutes / day for 3 days / more, or doing moderate activities for 5 days or more or walking for at least 30 minutes / day, or carrying out a combination of heavy, moderate, and walking activities in 5 days or more with intensity minimum 600 MET-minutes / week; Light: People who do not fulfill one of all the criteria that have been mentioned in the hight category or medium category. And the parameters of uric acid levels are normal from 2.6 to 6.0 mg / dl for women and 3.5-7.0 mg / dl for men; and hyperuricemia> 6.0 mg / dl for women and> 7.0 mg / dl for men.

This research was conducted from April to May 2016 in the Work Area of Sobo Health Center, Banyuwangi Regency. Starting from data collection then editing, coding, and tabulation, then the data was analyzed manually using the Spearman Rank test, this test was used to test the significance of the correlative hypothesis between two variables with an ordinal data scale. This test aims to determine the relationship of intensity of physical activity

with levels of uric acid. After a manual calculation is done to interpret the results, a comparison is calculated ρ by ρ table with α = 5%. If ρ count > from ρ table, Ho is rejected, which means that there is a relationship between the intensity of physical activity and uric acid levels. But if ρ counts ≤ from ρ table then Ho is accepted which means there is no relationship between the intensity of physical activity with uric acid levels.

RESULT

1. **The intensity of Physical Activity at gout arthritis patients in the 2016 Sobo Banyuwangi Health Center Work Area**

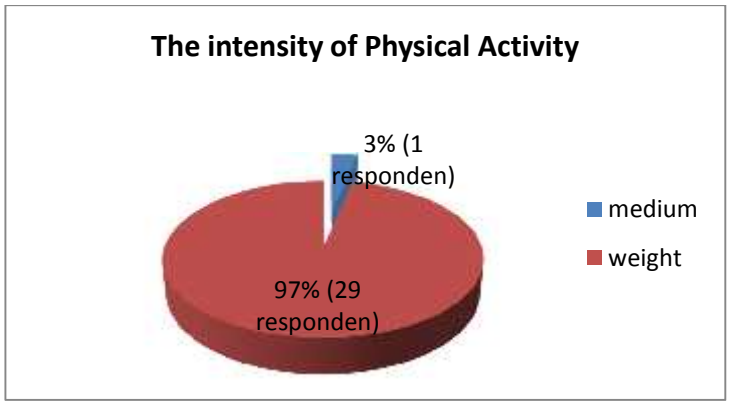

Diagram 1. Distribution of respondents based on the intensity of Physical Activity respondents in the 2016 public Health Center Sobo Banyuwangi work area

Based on Diagram 1 above, it was obtained the data that the majority of respondents carried out high activities as many as 29 people (97%).

2. **Uric Acid Levels in gout arthritis patients in 2016 Work Area of Sobo Banyuwangi Health Center**

Table 1. Distribution of respondents based on uric acid levels of respondents in the 2016 Sobo Banyuwangi Health Center work area.

	Man	Percentage	Woman	Percentage
Normal	2	20%	7	35%
Hyperuricemia	8	80%	13	65%
Total	10	100%	20	100%

Based on Table 1 above, it is obtained data that out of 10 male respondents, the majority had excessive uric acid levels of 8 people (80%), and from 20 female respondents, more than 50% had excess uric acid levels as many as 13 people (65%).

3. The Relationship between Intensity of Physical Activity and Uric Acid Levels in gout arthritis patients in 2016 Sobo Banyuwangi Health Center Work Areas

Table 2. Frequency Distribution of the Relationship between Intensity of Physical Activity and Uric Acid Levels in gout arthritis patients in 2016 Sobo Banyuwangi Health Center Work Areas

Uric Acid Levels	Intensity of Physical Activity						Total (%)	
	Light		Medium		High			
	N	%	N	%	N	%	N	%
Normal	-	-	1	3	6	20	7	23%
Hiperuricemia	-	-	-	-	23	77	23	77%
Total	-	-	1	3%	29	97%	30	100%

From Table 2 above-obtained data that most of the samples that carried out high physical activity were 29 people. The 23 respondents (77%) showed hyperuricemia / high uric acid levels and 6 respondents (20%) including uric acid levels within normal limits. While 1 respondent had moderate activity and had uric acid levels within the normal range (3%).

Based on the data above, an analysis of the relationship between the intensity of Physical Activity and uric acid levels at gout arthritis patients in the 2016 Sobo Banyuwangi Community Health Center work area using the Spearman Rank Test with a significant level of 0.05 (5%).

For sample sizes ($n \leq 30$)

Formula : $\rho = 1 - (6\Sigma di^2 : n (n^2 - 1)$

$$\rho = 1 - \frac{(6 \times 2396{,}5)}{30\,(30^2 - 1)} = 1 - 0{,}53315 = 0{,}46685$$

After the Spearman Rank Statistics Test was carried out, the data ρ count = 0.46685, while ρ table = 0.364 with the number of respondents 30, the significance level is 5% = 0.364. So it can be concluded that ρ counts 0.46685 > ρ table 0.364, then Ha is accepted and Ho is rejected which means that there is a significant relationship between the intensity of Physical Activity and uric acid levels at gout arthritis patients in the 2016 Sobo Banyuwangi Health Center work area and its relationship moderate.

DISCUSSION

1. The intensity of Physical Activity

Based on the research data in Diagram 1, it was obtained data that most of the respondents carried out the high physical activity as many as 29 people (97%). Physical activity is the movement of limbs which causes energy expenditure which is very important for the maintenance of physical and mental health, as well as maintaining the quality of life in order to stay healthy and fit throughout the day. Physical activity is divided into 3, namely: low, medium and high (14). there are three meaningful aspects that can describe the level of one's physical activity, namely work, sports and leisure activities (15).

Everyone must have physical activity in their daily lives, both men, and women. The amount of physical activity is different for each individual, depending on the individual lifestyle and other factors. Through the Global Physical Activity Questionnaire (GPAQ) questionnaire, it is obtained data that the majority of respondents carry out physical activities that drain energy when doing physical activity in the workplace. Starting from doing physical activity with moderate to high categories. It is proven that the percentage of male respondents who carry out physical activities with high intensity reaches 100%, while the female respondents reach 95%.

Routines carried out by respondents vary. For example, women clearly do a variety of activities in household activities, ranging from waking up already having to prepare family breakfast needs, preparing their children's school needs, doing homework such as sweeping, mopping, washing dishes, washing clothes, and a series of other activities to do and it is classified as a medium activity, then when at work it will be burdened with activities in the workplace. Whereas men, activities carried out are not the same as those carried out by women. Activities carried out by men are mostly classified as high-intensity activities where this is usually related to the type of work. In addition, the location of the activity can also affect the energy expenditure needed.

Jobs as farmers and construction workers have different types of activities with office workers. From this type of work shows the activities carried out by farmers and coolies are classified as high-intensity activities. The location was outdoors which was exposed to sunlight. So that the majority of activities require considerable energy expenditure. While office workers in the type of activities carried out are classified as medium intensity activities and their location is indoors. So that it doesn't need much energy. With various types of work, the intensity of physical activity carried out varies. Starting from low, medium to high activities that require the muscles of the limbs to function properly, so that it can support physical activities carried out daily.

Based on age, most respondents have ages between 30-50 years, that age is in the middle adulthood category. Middle Adulthood is a period of development that starts at the age of about 35 to 45 years and stretches to the age of sixty. At this age, a person belongs to the productive age with the condition of organs that can perform their functions to the maximum. This is a time to expand personal and social involvement and responsibility. Most people fill their activities by working, actualizing themselves to achieve desires and maintaining satisfaction in a career (16).

2. Uric Acid Levels

Based on diagram 1 above, which shows the data that out of 10 male respondents, most of them had excessive uric acid levels of 8 people (80%), and of the 20 female respondents, most also had excessive uric acid levels of 13 people (65%).

Uric acid is an acid in the form of crystals which is the end result of purine metabolism (a form of nucleoprotein derivatives), which is one component of nucleic acids found in the nucleus of body cells. On every normal metabolism, uric acid is produced. Normal uric acid levels in men range from 3.5 to 7 mg/dl and in women 2.6 to 6 mg/dl. Uric acid levels that exceed normal limits are called hyperuricemia (17).

Gout can affect anyone and regardless of age. However, this disease attacks more men than women, because men have higher levels of uric acid than women (18). In most respondents, men are more likely to experience high levels of uric acid than women. Because in women, having estrogen which is high enough before menopause. As is known that this hormone will help remove uric acid in the blood through urination. While men do not have a high estrogen hormone, so uric acid is difficult to pass through urine and the risk is that uric acid levels can be high (hyperuricemia). Hyperuricemia is more common in men ≥ 45 years because uric acid levels in men tend to increase with age. In women who menopause also have a risk to experience increased levels of uric acid, because in women who have menopause will obviously experience a decrease in the production of estrogen.

hyperuricemia can also be triggered by physical activity carried out by individuals. exercise/body movements will produce energy, besides that the body will also produce lactic acid (8). High activity will trigger an increase in lactic acid in the blood. While the buildup of lactic acid in the blood will reduce the release of uric acid by the kidneys.

Based on interviews from several respondents, it turns out they rarely have time to exercise because they are busy with their activities. Regular exercise is still needed, even though someone has gout. It aims to expedite the removal of excess uric acid from the body so that uric acid levels can stabilize again. But not all types of exercise can be done by gout sufferers. The type of exercise that is recommended for gout sufferers is a type of exercise that can overcome stiffness in joints where uric acid accumulates. For example, walking or light exercise.

3. The relationship between Intensity of Physical Activity and Uric Acid Levels

After analyzing the data, the calculated ρ was 0.46685 with a significance level of 0.05% and the price of ρ in the table was 0.364. Thus ρ count (0.46685) ≥ ρ table (0.364). So Ho was rejected and Ha was accepted, which means there was a significant relationship between the intensity of Physical Activity and levels of uric acid at gout arthritis patients in the 2016 Sobo Banyuwangi Public Health Center work area with a moderate level of relationship.

Excessive physical activity is associated with accumulation of uric acid levels in the blood. The intensity of Physical Activity is divided into 3, namely: low, medium and high (14). Every human being needs energy expended every time he moves. Energy needs to depend on the intensity and length of activity undertaken (19). The process of energy production in the body can run through two metabolic processes, namely aerobic metabolism and anaerobic metabolism (20). Metabolism of the energy of burning fat and carbohydrates in the presence of oxygen (O2) is called aerobic metabolism. While the

process of energy metabolism without the presence of oxygen (O2) is called anaerobic metabolism (20). The amount of energy needs depends on three areas of energy released, namely: basal metabolic rate + specific dynamic action + physical activity (19,20).

In anaerobic metabolism, blood flow is not enough to provide oxygen to the muscles, energy is obtained mainly from carbohydrates. The initial energy supply comes from the anaerobic adenosine triphosphate (ATP) catabolism process found in the muscle. The occurrence of muscle contraction due to the energy obtained from changes in ATP to ADP. ATP becomes ADP + energy release. The next energy is obtained from the decomposition of creatine phosphate which can quickly produce ATP, but creatine storage is very limited so that the energy produced is only for a few seconds (20). The most anaerobic energy is obtained from changes in carbohydrates to lactic acid (19).

Most people who carry out high-intensity activities often complain of joint pain when outside their work activities. Sometimes the pain appears at night, and also in the morning when you wake up. This can be caused by the buildup of uric acid in the joints. If this is left unchecked, there will be more severe complications. Physical activities such as lifting heavy weights, hoeing, gardening or other types of physical activities that require large amounts of energy quickly are dominant physical activities using anaerobic energy metabolism that produces the final product of lactic acid.

Sometimes people who do high activity uric acid levels remain within normal limits. It was proven that out of 29 respondents who carried out physical activities with high intensity, 6 respondents (around 21%) including uric acid levels remained within normal limits. In addition to physical activity, an increase in uric acid levels can also be influenced by other factors.

Lactic acid is formed by the process of glycolysis that occurs in muscles (8). Lactic acid helps maintain energy production, but ultimately must be released by the body, as excess lactic acid contributes to lactic acidosis and muscle pain. The intensity level of the exercise in which lactic acid starts to accumulate in the bloodstream marks the limits of anaerobic energy production, and hence efficient exercise, known as lactate threshold (LT) or anaerobic threshold (AT) (21). If there is an increase in lactic acid in the blood, it can cause a decrease in uric acid secretion (8,22). As a result, this triggers a buildup of uric acid, so blood uric acid levels tend to increase which is often referred to as hyperuricemia.

Thus, the higher the activity carried out by a person, the higher level of lactic acid which triggers an increase in uric acid. However, not many of the respondents knew the chronology of gout or its treatment. The lack of knowledge and busyness in work activities often makes them indifferent to the symptoms they feel. Therefore, it is important for individuals to avoid things that can worsen the condition of gout itself. And also to increase the motivation of each individual to change his life pattern to be healthier.

CONCLUSION

The conclusion of the study "the relationship between the level of physical activity and uric acid levels at 30-50 years of age in the 2016 Sobo Banyuwangi Health Center work area" are:

1. Based on the results of research on the intensity of Physical Activity in 30 respondents, showed that the majority of respondents carried out physical activities in the high category which was calculated by MET-minutes / week as many as 29 people (97%).
2. Based on the results of research on uric acid levels obtained data that of 10 male respondents, most had excessive uric acid levels of 8 people (80%), and from 20 female respondents, more than 50% also had uric acid levels excess is 13 people (65%).
3. Based on the results of the study it can be concluded that there is a relationship between the intensity of Physical Activity and levels of uric acid at gout arthritis patients in the 2016 Sobo Banyuwangi Health Center work area. Where the results of the Spearman rank statistics test obtained data ρ count (0.46685) ≥ ρ table (0.364) which means that Ho is rejected and Ha is accepted.

Declarations

Authors' contributions

These authors contributed equally to this work

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

I approve of my research data is publicated

Competing interests

There aren’t conflicts of interests in the study

Funding

Publication of this article was funded by Universitas Brawijaya

REFERENCES

1. Wulandari E. Deteksi, pencegahan dan pengobatan asam urat. Jawa Tengah: V-media; 2014.
2. Saryono dan Andri A. Analisis Faktor-Faktor yang Mempengaruhi Kadar Asam Urat Pada Pekerja Kantor di Desa Karang Turi, Kecamatan Bumiayu, Kabupaten Brebes. J Keperawatan Soedirman [Internet]. 2009;4(1):25–31. Available from: http://jks.fikes.unsoed.ac.id/index.php/jks/article/view/219/110
3. Khomsan A. Pangan Dan Gizi Untuk Kesehatan. 1st ed. Jakarta: RajaGrafindo Persada; 2010.
4. Wallace KL, Riedel AA, Joseph-Ridge N, Wortmann R. Increasing prevalence of gout

and hyperuricemia over 10 years among older adults in a managed care population. J Rheumatol. 2004;

5. Annemans L, Spaepen E, Gaskin M, Bonnemaire M, Malier V, Gilbert T, et al. Gout in the UK and Germany: Prevalence, comorbidities and management in general practice 2000-2005. Ann Rheum Dis. 2008;67(7):960–6.
6. Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI. Riset Kesehatan Dasar (RISKESDAS) 2013. Laporan Nasional 2013. 2013.
7. Kartikawati E. Pengantar diet untuk kolesterol dan asam urat. Jawa Tengah: V-media; 2012.
8. Mayers PA. Glikolisis dan Oksidasi Piruvat, Biokimia Harper. Jakarta: EGC; 2003.
9. Damayanti D. Perencanaan menu untuk penderita gangguan asam urat. 12th ed. Jakarta: Penebar Swadaya; 2012.
10. Aqila Smart. Rematik dan Asam Urat. Yogyakarta: A Plus Books; 2010.
11. Ifan. Olahraga untuk penderita asam urat [Internet]. 2011. Available from: http://obatonline.com
12. Nahariani P, Lismawati P, Wibowo H. Hubungan Antara Aktivias Fisik Dengan Intensitas Nyeri Sendi Pada Lansia Di Pandi Werdha Mojopahit Kabupaten Mojokerto. 2015;34–9. Available from: http://www.stikespemkabjombang.ac.id/ejurnal/index.php/April-2013/article/download/10/13
13. Notoadmodjo S. Metodologi Penelitian Kesehatan. Jakarta : PT. Rineka Cipta. 2012.
14. WHO. Phisychal Activity In Guide to Community Preventive Servis Web site [Internet]. 2010. Available from: http://www.who.int/chp/steps
15. Fatmah, Ruhayati Y. Gizi Kebugaran dan Olahraga. Bandung: Penerbit Lubuk Agung; 2011.
16. Erik H. Encyclopedia of Child Behavior and Development. 2011;(January 2011). Available from: http://link.springer.com/10.1007/978-0-387-79061-9
17. Dianati NA. Gout and hyperuricemia. J Major [Internet]. 2015;4(3):82–9. Available from: http://juke.kedokteran.unila.ac.id/index.php/majority/article/viewFile/555/556
18. Utami. Penatalaksanaan penyakit asam urat. Jakarta: EGC; 2010.
19. Mihardja L. Sistem Energi dan Zat Gizi yang Diperlukan pada Olahraga Aerobik dan Anaerobik. Fakultas Kedokteran, Universitas Indonesia. 2004;9–13.
20. Hernawati H. Produksi Asam Laktat Pada Exercise Aerobik Dan Anaerobik. Fpmipa Upi. 2013;1–2.

21. Faude O, Kindermann W, Meyer T. Lactate threshold concepts: How valid are they? Sport Med. 2009;39(6):469–90.
22. Krisnatuti D, Yenrina R, Uripi V. Perencanaan Menu untuk Penderita Asam Urat. Jakarta: Penebar Swadaya; 2007.