URIC ACID CONCENTRATION WITH RISK FACTORS FOR HYPERTENSION WITH CORONARY HEART DISEASE PATIENTS WHO DO MODERATY INTENSITY PHYSICAL EXERCISE

Nindya Amalia[1)], Sianty Dewi[2)], Dyana Sarvasti[3)]

ABSTRACT

Introduction: Complication of hypertension causes 45% of deaths from heart disease. Programs for improving quality of life in heart disease patients such as Cardiovascular Prevention and Rehabilitation program, usually includes one component, which is to do moderate-intensity physical exercise. previous study suggested that moderate-to-high intensity physical exercise could increase uric acid.
Aim: To examine the correlation between uric acid concentration and risk factors for hypertension in patients with coronary heart disease who do moderate intensity physical exercise.
Method: This was a retrospective study using data from medical records with cross-sectional design. The sampling method used purposive sampling based on subjective consideration and the availability of certain criteria. Analysis used chi-square analysis
Results: The data were taken from medical records from 2012 until July 2019. Sampling, which appropriates for inclusion and exclusion criteria in Husada Utama Hospital, was 30 samples, 25 male, and 5 female. The majority of subjects in this research was 56-65 years old. The youngest was 40 years old while the oldest was 77 years old. Data analysis results showed that patients who had hypertension risk factors and increased uric acid were 17 patients (85%) and who did not have hypertension risk factors1. They did not experience an increase were seven people (70%) from the chi-square test. significant with p = 0.003 (p <0.05).
Conclusion: There is a significant correlation between uric acid concentration and risk factors for hypertension in patients with coronary heart disease who do moderate-intensity physical exercise.

Keywords: uric acid concentration, hypertension, CHD (coronary heart disease), moderate-intensity physical exercise

[1)]Student of Faculty of Medicine, Widya Mandala Catholic University Surabaya, Jl Kalisari Selatan No.1 Surabaya. Email : nindya0366@gmail.com
[2)]Department of Obstetrics and Gynecology, Faculty of Medicine, Widya Mandala Catholic University Surabaya, Jl Kalisari Selatan No.1 Surabaya
[3)]Department of Cardiovascular Medicine, Faculty of Medicine, Widya Mandala Catholic University Surabaya**,** Jl. Kalisari Selatan No.1 Surabaya

INTRODUCTION

Primary health care facilities in Indonesia still face challenges, and hypertension is a common occurrence. According to the 2013 and 2018 Basic Health Research data, the prevalence of hypertension increases from 25.8% to 34.1%. The mortality rate from hypertension complications in the world reached 9.4%, where 45% is caused by cardiac disease and 51% caused by stroke. The main cardiovascular disease leads to death is coronary heart disease, and it is expected to increase to 23.3 million death in 2030.[1]

Cardiovascular prevention and rehabilitation program is a secondary prevention effort given to patients with cardiovascular disease, including preventing reoccurrence (heart attack) and inhibiting the progression of disease, which comprehensively decrease risk and increase patients, quality of life.[2] This program involves a multidisciplinary team consisting of cardiologist, physiotherapist, psychologist, nutritionist and physical trainer which aims to optimize and recover physical, mental and social functions.[3]

Physical exercise in cardiovascular disease patients is adjusted according to age, comorbidity, preference, and purpose.[4] Based on intensity, physical exercise is divided into low, moderate, high, and very high. Coronary heart disease patients are recommended to participate in moderate physical exercise, including 30-60 minutes of aerobic exercise or daily physical activities.[5] Moderate-intensity physical exercise can have benefits in decreasing the risk of cardiovascular disease and decreasing morbidity and mortality.[6] The intensity is measured using heart rate reserve, BORG scale and metabolic equivalents (METs).[7]

Kusumadewi obtained a correlation between physical activity and increased uric acid. In contrast, moderate to high-intensity physical activity had 2.56 times the risk of increased uric acid in the metabolic syndrome population.[8] In hypertension conditions, kidney perfusion decreased, which can stimulate the reabsorption of uric acid, thus increasing the concentration of uric acid in the blood. Local tissue ischemic conditions in microvascular disease can also be caused by hypertension.[9,10] High-intensity physical exercise produced more free radicals. It can cause oxidative stress, which depends on the mode, intensity, and training duration.[11] Oxygen absorption in the body will increase 100-200 times during high-intensity physical exercise.[12,13] Uric acid in coronary heart disease patients is associated with metabolic syndrome, which can lead to endothelial dysfunction, vascular inflammation, and hypertension. It may contribute to atherosclerosis.[14] The

phenomenon that occurs after performing moderate physical exercise for four weeks includes increased concentration of uric acid. According to the statements above, the author would like to determine the correlation between uric acid concentration and risk factor of hypertension in coronary heart disease patients who underwent moderate-intensity physical exercise.

METHOD

The design used in this study was observational analytic conducted retrospectively with a cross-sectional approach. This study used secondary data, the medical records of coronary heart disease patients after cardiovascular prevention and rehabilitation program in Husada Utama Hospital, Surabaya.

The population in this study was all coronary heart disease patients who participated in cardiovascular prevention and rehabilitation program in Husada Utama Hospital, Surabaya.

The samples in this study were all medical records of coronary heart disease patients who participated in cardiovascular prevention and rehabilitation program in Husada Utama Hospital Surabaya, who met inclusion and exclusion criteria. Data were obtained from July 2012-2019 medical records. The sampling technique used in this study was non-probability sampling, which was purposive sampling. All populations who met inclusion criteria were included. The inclusion criteria in this study include the medical record of patients with coronary heart disease diagnosis, had blood pressure data (with and without have hypertension risk factors), participated in phase 2 cardiovascular prevention and rehabilitation program, have uric acid level data before and after cardiovascular prevention and rehabilitation program. Meanwhile, the exclusion criteria include the medical record of patients with incomplete uric acid data before and after moderate-intensity physical exercise and who consumed medications for uric acid.

RESULTS

The characteristics of CHD patients who participated in cardiovascular prevention and rehabilitation program in Husada Utama Hospital Surabaya with 30 samples and 100% percentage are as follows.

Table 1. Patient characteristics according to gender

Gender	Frequency (n)	Percentage (%)
Male	25	83,3%
Female	5	16,7%

Table 2. Patient characteristics according to age

Uric acid level before moderate intensity physical exercise	Frequency(n)	Percentage (%)
Increased	2	6,7%
Didn't increased	28	93,3%

Table 3. Patient characteristics according to hypertension risk factor

Age	Frequency (n)	Percentage (%)
Late adulthood (36-45 age)	2	6,7%
Early elderly (46-55 age)	10	33,3%
Late elderly (56-65 age)	14	46,7%
Geriatric	4	13,3%

Table 4. Patient characteristics according to uric acid level before moderate intensity physical exercise (increased, did not increased)

Hypertention	Frequency (n)	Percentage (%)
Yes	20	66,7%
No	12	33,3%

Table 5. Patient characteristics according to uric acid level after moderate intensity physical exercise

Uric acid level after moderate intensity physical exercise	Frequency(n)	Percentage (%)
Increased	20	66,7%
Didn't increased	10	33,3%

Table 6. Patient characteristics according to diabetes mellitus risk factor

Diabetes Melitus	Frequency (n)	Percentage (%)
Yes	19	63,3%
No	11	36,7%

Table 7. Patient characteristics according to smoking risk factor

Smoking	Frequency (n)	Percentage (%)
Yes	20	66,7%
No	10	33,3%

Table 8. Patient characteristics according to dyslipidemia risk factor

Dyslipidemia	Frequency (n)	Percentage (%)
Yes	17	56,7%
No	13	43,3%

Table 9. Patient characteristics according to obesity risk factor

Obesity	Frequency (n)	Percentage (%)
Yes	12	40%
No	18	60%

Table 10. Patient characteristics according to hereditary risk factor of coronary heart disease

Heredity risk factor of CHD	Frequency (n)	Percentage (%)
Yes	10	33,3%
No	20	66,7%

Table 11. Patient characteristics according to lack of exercise risk factor

Lack of exercise risk factor	Frequency(n)	Percentage(%)
Yes	17	56,7%
No	13	43,3%

Table 12. Analysis of correlation between uric acid concentration and hypertension risk factor in coronary heart disease who participated in moderate intensity physical activity; results of Chi-square statistical test

	Increased Uric Acid Concentration			
Hypertention risk factor	Yes	No	Total	P Value
Yes	17 (85%)	3 (15%)	20 (100%)	0,003
No	3 (30%)	7 (70%)	10 (100%)	
Total	20 (66,7%)	10 (33,3%)	30 (100%)	

Table 12 describes the analysis of the correlation between uric acid concentration in coronary heart disease patient and hypertension risk factors. The chi-square statistical test result revealed $p = 0.003$ ($p < 0.05$), which concludes that there was a significant correlation between the hypertension risk factor and uric acid concentration.

DISCUSSION

The results of this study found that there was a significant correlation between a hypertension risk factor and uric acid concentration. The subjects of this study were mostly male, which was in accordance with Radi Basuni et al., which

investigated cardiovascular rehabilitation in Indonesia, published in the Indonesian cardiology journal in 2009, who stated that patients who participated in cardiovascular prevention and rehabilitation were mostly male (81%).[15] The oldest age was 77 years, and the youngest was 40. The 2013 Basic Health Research (Riskesdas) stated that the most frequent age in coronary heart disease was > 65 years old.16 The most common age group in this study was not in line with the results of Riskesdas, which can be attributed to unhealthy lifestyle tendency since an early age, which was evident by the CHD risk factors owned by said age group, including smoking habit, obesity, dyslipidemia, and lack of exercise.

Kusumadewi et al. obtained significant positive correlation between moderate-intensity physical activity and serum uric acid level in metabolic syndrome population, whereas moderate to high-intensity physical activity had 2.56 times risk of hyperuricemia with Spearman test result of ($r = 0.491$; $p = 0.004$).[8]

Increased uric acid found in this study can be attributed to the hypertension risk factor. During physical exercise, the body metabolism produces several oxidants in the biological system, including superoxide, hydrogen peroxide, and hydroxyl radical, a reactive oxygen species (ROS).[17] Oxygen absorption increases higher during intense exercise compared to resting. Temperature rise can occur, which can trigger hyperthermia due to increased consumption of ROS oxygen and can cause increased uric acid levels.[12,13,18] Hypertension can cause glomerular filtration rate to decrease. Uric acid enters the kidney to be excreted by the urine, which will pass through glomerular filtration. Thus, a decrease in the glomerular filtration rate can cause decreased urine excretion, leading to reduced uric acid excretion through urine.[9,10] Hypertension can also cause microvascular disease, which produced local tissue ischemia. Ischemia leads to increased free radicals or reactive oxygen species (ROS). It causes oxidative stress, which causes ATP breakdown to ADP. Increasing ADP can convert xanthine dehydrogenase to xanthine oxidase, and hypoxanthine to uric acid.[19]

The increased concentration of uric acid in CHD patients with hypertension risk factors was probably caused by hypertension. Therefore, the already increased uric acid in hypertension patients without therapy, cannot be controlled.

CONCLUSION

This study concludes that there was a significant correlation between uric acid concentration and hypertension risk factors in coronary heart disease patients who performed moderate-intensity physical

exercise. Coronary heart disease patients with hypertension risk factors underwent increased uric acid concentration after performing the moderate-intensity physical exercise for four weeks.

ACKNOWLEDGEMENT

1. Faculty of Medicine, Widya Mandala Catholic University
2. Husada Utama Hospital, Surabaya who gave permission for data collection.
3. Fellow batch 2016 colleagues in Faculty of Medicine, Widya Mandala Catholic University, Surabaya

REFERENCES

1. Kemenkes RI. Situasi kesehatan jantung. Pusat data dan informasi kementerian kesehatan RI. 2014. P 3. Available from: http://www.depkes.go.id/download.php?file=download/pusdatin/infodatin/infodatin-jantung.pdf

2. Smith SC, Benjamin EJ, Bonow RO, Braun LT, Creager MA, Franklin BA, et al. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update. J Am Coll Cardiol. 2011;58(23):2432–2446. Available from: https://depts.washington.edu/uwmedres/pdf/articles/2011%20AHA%20secondary%20prevention%20guidelines.pdf

3. Ades PA, Balady GJ, Franklin BA, Yancy CW, Gordon NF, Bittner VA, et al. Referral, enrollment, and delivery of cardiac rehabilitation/secondary prevention programs at clinical centers and beyond. Circulation. 2011;124(25):2951–2960. Available from: https://pdfs.semanticscholar.org/1566/3da7547853496ffc7cf700586e9ae2b5465d.pdf

4. Schmid J-P, Wood D, Carre F, Benzer W, McGee H, Mendes M, et al. Secondary prevention through cardiac rehabilitation: physical activity counselling and exercise training: Key components of the position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation. Eur Heart J. 2010;31(16):1967–1974. Available from: https://pdfs.semanticscholar.org/621f/aaa83bf3144402f8c4b49ebb532a3880a7e0.pdf

5. Franklin BA, Lavie CJ, Squires RW, Milani R V. Exercise-based cardiac rehabilitation and improvements in

cardiorespiratory fitness: implications regarding patient benefit. Mayo Clin Proc. 2013;88(5):431–437. Available from: https://www.mayoclinicproceedings.org/article/S0025-6196(13)00225-5/pdf

6. Wibisono E, Susilo A, Nainggolan L. Kapita Selekta Kedokteran. 4th ed. Tanto C, Liwang F, Hanifati S PE, editor. Media Aesculapius. 2014.
7. Saner H, Mcgee H, Hellemans I, Monpere C. Cardiovascular prevention and rehabilitation. London: Springer; 2007.
8. Kusumadewi F, Sumekar TA. Hubungan antara intensitas aktivitas fisik dan kadar asam urat serum pada populasi sindrom metabolik. Kedokteran, Univ Diponegoro. 2015;4(4):723–731. Available from: https://ejournal3.undip.ac.id/index.php/medico/index
9. Robiyatul H. Hubungan antara peningkatan kadar asam urat darah dengan kejadian hipertensi di RSUD Sukoharjo. Skripsi Universitas Muhammadiyah Surakarta; 2015. Available from: http://eprints.ums.ac.id/39488/17/NASKAH%20PUBLIKASI.pdf
10. Johnson RJ, Kang DH, Feig D, Kivlighn S, Kanellis J, Watanabe S, et al. Is there a pathogenetic role for uric acid in hypertension and cardiovascular and renal disease? Hypertension. 2003;41(6):1183–1190. Available from: https://www.ahajournals.org/doi/pdf/10.1161/01.HYP.0000069700.62727.C5
11. Boccatonda A., Tripaldi R., Davì G., Santilli F. Oxidative stress modulation through habitual physical activity. Curr Pharm Des., 22: 3648-3680, 2016. Available from: https://serval.unil.ch/resource/serval:BIB_7F872FE8DF7C.P001/REF
12. Chevion S, Moran DS, Heled Y, Shani Y, Regev G, Abbou B, et al. Plasma antioxidant status and cell injury after severe physical exercise. Proc Natl Acad Sci. 2003;100(9):5119–5123. Available from: https://pdfs.semanticscholar.org/1677/5029e1b7faec7d94dbc118d98d9c3d3d87b9.pdf
13. Deaton CM, Marlin DJ Exercise associated oxidative stress. Clin Tech Equine Prac 2003;2(3),278-2791. Available from: https://www.sciencedirect.com/journal/clinical-techniques-in-equine-practice

14. Meisinger C, Koenig W, Baumert J, Döring A. Uric acid levels are associated with all-cause and cardiovascular disease mortality independent of systemic inflammation in men from the general population the MONICA ORA cohort study. Arterioscler Thromb Vasc Biol. 2008;28(6):1186–1192. Available from:https://www.ahajournals.org/doi/pdf/10.1161/ATVBAHA.107.160184
15. Radi B, Joesoef AH, Kusmana D. Rehabilitasi Kardiovaskular Di Indonesia. 2009;30(2):43–5. Available from: http://ijconline.id/index.php/ijc/article/download/162/165/
16. Kementerian Kesehatan Republik Indonesia. Hasil Riset Kesehatan Dasar Kementerian RI 2013. Proceedings, Annu Meet - Air Pollut Control Assoc [Internet]. 2013;6. Available from: http://www.depkes.go.id/resources/download/general/Hasil Riskesdas 2013.pdf
17. Murray RK, Granner DK, Mayes PA, Rodwell VW. Harper's Illustrated Biochemistry (31st Edition). Biochemical Education. 2018.
18. InfoDATIN. Mencegah dan mengontrol hipertensi agar terhindar dari kerusakan organ jantung. Pusat Data dan Informasi Kementerian Kesehatan RI. 2014;3-4.
19. Sargowo D. Patogenesis aterosklerosis. Malang: UBPress, 2015. P 298 .