**Contributions of Body mass index (BMI), Smoking and Physical Activity on Blood Pressure Reactivity (Correlational study on student of STIKES Bina Putera Banjar City)**

Farid Rahman1, Muchsin Doewes2, Noer Rachma3

1. Student of Sport Science Graduate, Sebelas Maret University of Surakarta, Indonesia
2. Departement of Pharmacology, Faculty of Medicine, Sebelas Maret University of Surakarta, Indonesia
3. Departement of Medical Rehabilitation, Dr. Moewardi Hospital/ Faculty of Medicine, Sebelas Maret University of Surakarta, Indonesia.

**Abstract**. [Purpose] This study is designed to know the contribution of body mass index (BMI), smoking and physical activity on blood pressure reactivity. [Subject and Methods] Sixty students female and male were conducted for this research who were based on inclusion criteria. The subjects conducted some measurements and test. These were body mass index for BMI (kg/m2), *Fagerstrom Test for Nicotine Dependence* for smoking, *International Physical Activity Questionare (IPAQ)* (METS) for physical activity and *Cold Pressor Test* (mmHg) for blood pressure reactivity. [Result] Research showed that body mass index (BMI), smoking and physical activity have correlation on blood pressure reactivity both partial and simultaneous analyse. First, If there is altering of body mass index (BMI), it will raise blood pressure activity for 53,1 %. Second, if there is decrease of physical activity, it will raise blood pressure activity for 46,4 %. Third, if there is altering of smoking, it will raise blood pressure activity for 15,9 %. [Conclusion] The study above showed that body mass index, smoking, and physical activity have contribution for either of partial or simultaneous on blood pressure reactivity.

Keywords: Body mass index, smoking, physical activity, blood pressure reactivity.

**Introduction**

9.4 Millions people based on global estimated suffered for hypertension. There is prediction 1 billion people will get hypertension in the following years. Hypertension becomes one of risk factor for cardiovascular dissease estimated for 45% and 51% will be responsible for stroke risk as well. The corelation over the risk will be progressive, sustainable and independent (Bezner, 2015).

Changing of life style become important factor for hypertension risk. Advance technology together along with change of life style make its risk become terrible. Obesity as one of worldwide major problem contribute for hypertension (Zheng *et.al*., 2014) . The another one is smoking cessation which destruct the body physiological function by its chemical contain. The easier life provided by advance technology create most of population trapped for sedentary life espescially less of physical activity. Less physical activity means there is less of callories burning so following of process it can make progressive of weight gain which known contribute for cardiovascular damage then hypertension (Sinku, 2012).

The origin of hypertension risk can be predicted since the young age with give attention for phsysiologic of cardiovasculerr (Mundewadi *et.al.*, 2011). One of indicator of hypertension we can see by blood pressure responsiveness toward stress stimulus (psychological, thermal and physical stress) (Qi Zhao *et.al.*, 2012). Since it known as one of cardiovascular test and indicator for vascular healthy, blood pressure responsiveness predict for hypertension if subject show for hypereactor criteria. Risk of hypertension known by hypereactor result of the stress test can help health worker to consider appropriate step and program to reduce of hypertension in the future by promoting for healthy life stlye and avoiding for sedentary life.

**Subjects and Methods**

The subjects of this study were students aged 18-26 who consented to participate in this study and signed inform of consent for this study. Those who were conducted this study should not drink caffeine or alcohol, did some exercise at least 24 hours before test and eat 3 hours before test. Those who had sensory disorder werent able to conduct this study.

Body Mass Index (BMI)

Body Mass index known by BMI considered body weight and body height. body weight was assessed by a digital scale (Idealife IL - 270) with a 100 g precision was used. Height was measured using a portable stadiometer (seca 213) with a 0.1 cm precision. During height measurements, the subjects remained at a standing position with their ankles, calves, buttocks, back, and head touching the wall. The head position was consistent with Frankfurt’s Plan, and the measurement was performed at the moment of inhaling air.

BMI was calculated from the divison of body weight (in kilograms) by height (in meters) raised to second power (kg/m2). Body mass index classification based according to World Health Organization (WHO) cut-off point criteria for asia people. Underweight: <18.5, ideal: between 18.5-<24.9, overweight: between >25-<29.9, Obesity: >30 (Nishida, 2004).

Smoking

Smoking acitivity was measured by Fagerstrom Test for Nicotine Dependence. The test was designed to provide an ordinal measure of nicotine dependence related to cigarette smoking. It contains six items that evaluate the quantity of cigarette consumption, the compulsion to use, and dependence. In scoring the Fagerstrom Test for Nicotine Dependence, yes/no items are scored from 0 to 1 and multiple-choice items are scored from 0 to 3. The items are summed to yield a total score of 0-10. The higher the total Fagerström score, the more intense is the patient's physical dependence on nicotine (Heatherton TF *et.al*., 1991).

Phyical Activity

In this study physical activity was assessed by a questionare which used globally, that was The International Physical Activity Questionnaire (IPAQ). It used as a standardised measure to estimate habitual practice of physical activities of populations from different countries and socio-cultural contexts. Two-forms of the IPAQ have been developed: a short and a long version, both of which involve 7-day recall of physical activity. The short-form (SF) was designed for use in surveillance studies, in which time is limited, and consists of 8 items to estimate the time spent performing physical activities (moderate to vigorous) and inactivity (time spent sitting). The long form (LF) was designed to provide a comprehensive evaluation of daily physical activities, and assesses the time spent walking, doing moderate-intensity and vigorous-intensity activity within the domains of work, transportation, domestic and gardening (yard) activities, and leisure-related activities (Maddison *et.al.*, 2007) .

Blood Pressure Reactivity

The blood pressure reactivity was measured by using cold pressor test (C PT). The subject position is sit or supine lying. The right hand up to wrist's subjects were immersed in a container filled with cold water (4 C to 10 C) for 1-2 minutes. The water temperature was controlled using a thermometer. Blood pressure reactivity was measured at 30-sec mark of the CPT during 2 minute then after CPT finished with 30-sec interval they were measured again for blood pressure. Blood pressure reactivity was classified as hyporeactor, normoreactor and hyperreactor (Mundewadi *et.al,* 2011)*.*

Statistical analysis use SPSS 20.0s oftware program aid. The first step is prerequisite test which determine for : normality data test, linierity, heteroskedastisitas, multicolinierity. Then the second one is hypotetic analysis (Sugiyono, 2013).

Result

This present study collected for three independent variable (body mass index (BMI), smoking, physical activity) and one dependent variable (blood pressure reactivity). The data was analysed by statistic to see value, category, frequency, mean, max and minimum. This study conducted for 60 subjects.

Data Description

Table 1 Body Mass Index Distribution

|  |  |  |  |
| --- | --- | --- | --- |
| Body Mass Index Variable | | Frequency | Percentage (%) |
| Range | Category |  |  |
| < 18.5 | *Underweight* | 6 | 10 |
| 18.5-24.99 | *Ideal* | 22 | 36,7 |
| 25.00-29.99 | *Pre-Obese* | 20 | 33,3 |
| >= 30.00 | *Obese* | 12 | 20 |
| Total | | 60 | 100 |

Table 2 Smoking Variable Distribution

|  |  |  |  |
| --- | --- | --- | --- |
| Smoking Variable | | Frequency | Percentage (%) |
| Range | Category |  |  |
| 1-2 | *Low dependence* | 17 | 28,3 |
| 3-4 | *Low to moderate dependence* | 29 | 48,3 |
| 5-7 | *Moderate dependence* | 14 | 23,3 |
| >8 | *High dependence* | 0 | 0 |
| Total | | 60 | 100 |

Table 3 Physical Activity Distribution

|  |  |  |  |
| --- | --- | --- | --- |
| Physical Activity Variable (METs) | | Frequency | Percentage (%) |
| Range | Category |  |  |
| <3494 | Low | 18 | 30 |
| 3494-6149 | Moderate | 29 | 48,3 |
| >6149 | High | 13 | 21,7 |
| Total | | 60 | 100 |

Table 4 Blood Pressure Reactivity Distributin

|  |  |  |  |
| --- | --- | --- | --- |
| Blood Pressure Reactivity | | Frequency | Percentage (%) |
| Range | Category |  |  |
| 0-20 | Normoreactor | 51 | 85 |
| >20 | Hypereactor | 9 | 15 |
| Total | | 60 | 100 |

Statistic Analyze

Table 5 t-partial variable analyze

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Value (r) | Sig. p | Conclusion | R Square |
| Body Mass Index | *.729* | *0.000* | Significant Positive Correlation | 0,531 |
| Smoking | *.398* | *0.001* | Significant Positive Correlation | 0,159 |
| Physical Activity | *-.681* | *0.000* | Significant Negative Correlation | 0,464 |

Table 6 Simultaneus Variable Static Analyze

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **F Hitung** | **F Table** | **Sig** | **R Square** |
| Body Mass Index, Smoking, and Physical Activity | 23,122 | 2,78 | .000 | 55,3 |

**Discussion**

Based of statistical analyze which showed positive correlation for body mass index and blood pressure reactivity p=0,000 (p<0,05) r= 0,729 with R square= 0,531. R square means that Body mass index has 53,1% contribute toward blood pressure reactivity.

Obes/overweight people has vascular change physiology function that lead for blood pressure raise. Symphatetic over activity lead as one of responsible factor for high blood pressure. its raising activity can affect for down regulation of B-adrenergic receptor which known can increas the total body energy expenditure. Symphatetic activity arousal leading to diminish of cardiac, vascular, glucose and phosphate responses (Cooper *et.al.*, 2012).

The another underlying process for high blood pressure is change of vascular structure and function. Vacular thickening due to weight gain will elicit vasoconstriction of vascular which will take raising of pheriperal resistance and cardiovascular over activity to produce great blood circulation by increase strength contraction. Cardiovascular over activity as a result of raising of symphatetic activity as well. Overweight/obesity has decrease of endhotelial dysfunction then decrease of nitrit oxyde (NO). NO is known as local vasodilator to mediator inhibit ca+ as one of vasoconstriction stimulator (Sherwood, 2007).

Based of statistical analyze which showed negative correlation for smoking and blood pressure reactivity p=0,001 (p<0,05) r= 0,398 with R square= 0,159. R square means that Body mass index has 15,9% contribute toward blood pressure reactivity. Underlying mechanism of smoking can be understood from nicotine as one chemical contain of cigarrette. Nicotine cause stimulation of noerepinefrin which known as great vasoconstrictor chemical substance. this stimulation for prolong time will take of vascular destruction with arterial thickening and stiffness. the another one of effect nicotine for vascular is decrease of Nitrit Oxyde (NO). It is very important of endhotelium derive relaxation factor. arterial stiffness, thickening and low of NO cause of decrease vascular distensibility. vascular distensibility is precious thing for vascular system which control vascular vasoconstriction (Benowitz, 2008).

Based of statistical analyze which showed negative correlation for physical activity and blood pressure reactivity p=0,001 (p<0,05) r= -0,681 with R square= 0,464. R square means that Body mass index has 46,4% contribute toward blood pressure reactivity. People who engaged for regularly physical exercise or active physical activity has good vascular condition so they can avoid from arterial stifness and endhotelial dysfunction that determine blood pressure as media for relaxation derive and local mechanism. Viceversa, people who less of regularly physical exercise or sedentery life style has decrease for cardiovascular systm. there is alteration for heart rate to raise stroke volume for great blood circulation to perifer. then, peripheral resistance will elicit make vasoconstriction mechanism, as result blood pressure raise higher (Monteiro and Filho, 2004).

**Conclusion**

The present study showed showed that body mass index, smoking, and physical activity have contribution for either of partial or simultaneous on blood pressure reactivity. Accordingly, based on the above study, promoting and applying of healthy life style should be engaged for people young age to avoid for hypertensive risk in the future. Applying like weight gain control, appropriate nutrition intake, stop for smoking, regular physical exercise or activity can boost healthier body and improve self-wellness. The upcoming study should consider nutrition, eating habit and psychological factors when planning to see effect/contribution of these factors toward blood pressure reactivity.

**References**

Bezner, JR. 2015 “Promoting health and wellness: implications for physical therapist practice.” Phys Ther; 95 (10):1433–1444.

Benowitz, Neal L.2008. Neurobiology of Nicotine Addiction: Implications for Smoking cessation Treatment. The American Journal of Medicine, 121(4A): S3–S10.

Cooper, Jennifer N. *et. al.* 2012.Reductions in arterial stiffness with weight loss in overweight and obese young adults: potential mechanisms. Atherosclerosis, 223(2): 485–490.

Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. 1991. The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *Br J Addict,* 86:1119-27.

Maddison, Ralph et.al. 2007. International Physical Activity Questionnaire (IPAQ) and New Zealand Physical Activity Questionnaire (NZPAQ): A doubly labelled water validation.*International Journal of Behavioral Nutrition and Physical Activity*, 4(62): 1-9

Monteiro, Maria de Fátima and Filho, Dário C. Sobral. 2004. Physical exercise and blood pressure control*. Rev Bras Med Esporte*, 10(6):517-519

Mundewadi, Shafique Ahmed A.W. *et.al.*.2011. Resting B.P. and Cold Pressor Test in Policemen in Dhule City. *International Journal of Basic Medical Science,* 2(4):80-83.

Nishida, Chizuru. 2004. “Appropriate Body-Mass Index For Asian Populations And Its Implications For Policy And Intervention Strategies”. *Journal The Lancet*, 363: 157-163.

Qi Zhao, *et.al.* 2012. Reproducibility of Blood Pressure Response to the Cold Pressor Test. *American Journal of Epidemiology*, 176 (7): S91-S98.

Sherwood, Lauralee. 2007. *Fisiologi Manusia: Dari Sel ke Sistem*.Terjemahan oleh dr. Brahm U. Pendit. 2012. Jakarta: Penerbit Buku Kedokteran EGC.

Sinku, S. 2012. Cardiovascular Fitness among Sedenatry Students. *Journal of Exercise Science and Physiotherapy*, 8 (2): 109-112.

Sugiyono, 2013. *Metode Penelitian Kombinasi (Mixed Methods)*. Bandung: ALFA BETA.