Ischemic Stroke Caused by Metabolite Factors in Indonesia (GBD Study 2017)

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Abstract

Ischemic stroke was one of the leading causes of death. There are 2 risk factors, namely can and cannot be modified. Metabolite factors can be modified. This article analyzes the 2017 GBD study data in Indonesia. Quantitative analysis of secondary data from the 2017 GBD. The dependent variables are DALYs, Death, YLL to YLD ratios. The independent variable is gender and 4 metabolite factors. Data were analyzed using descriptive and inferential statistics. The overall average value of ischemic stroke DALYs was 11334.26 (143440.73 - 145.95). The average ischemic stroke mortality rate is 489.03 (3.23 - 7170.45). The average ratio of YLL to YLD is 4.74 (0.86 - 7.70). YLL / YLD ratio values are greater than 1 for all metabolite factors. This ratio indicates that the YLL value dominates the DALYs value. The value of ischemic stroke burden in men is greater than in women. The highest value of stroke for metabolic factors in a row are high systolic, high fasting, high LDL and high Body Mass Index. The difference in sex does not affect the value of DALYs. High metabolite factors affect the value of DALYs. The YLL value dominates the DALYs value.

Key words: *Ischemic Stroke, Metabolite Factors, Global Burden of Diseases 2017*

Introduction

Ischemic stroke or commonly called a non-hemorrhagic stroke is the death of brain tissue due to disruption of blood flow to the brain region. This is due to cerebral or cervical artery blockages or cerebral veins that are less likely to be blocked.[1] Classification of ischemic stroke subtypes that are often used in studies is the Trial of ORG 10172 classification in Acute Stroke Treatment (TOAST), namely atherosclerosis of large blood vessels, cardioembolic , lacunar, other causes, and unknown causes.[2]

Stroke is the cause of death among 240 types of causes of death in the world and stroke is among the second highest types of causes of death after ischemic heart disease,[3] and is projected to remain so in 2030.[4] Patient with stroke generally suffer from disabilities, need temporary or lifelong assistance. Stroke can be a burden for the family who cared for it and stroke including catastrophic diseases or diseases that require very expensive healing costs.

Stroke is caused by 2 different risk factors, namely risk factors that can be modified and factors that cannot be modified. The main risk factors for stroke include age, history of cerebrovascular events, smoking, alcohol consumption, physical activity, hypertension, dyslipidemia, diabetes mellitus, cardiovascular disease, obesity, metabolic syndrome, diet, nutrition, and genetic risk factors.[5-6] In addition, the higher incidence of ischemic stroke shows that ischemic stroke patients have a large exposure to modifiable risk factors whose control through lifestyle modification can prevent most of these incidents.[7] In general, a strong association between several risk factors (such as hypertension, diabetes mellitus, dyslipidemia, smoking, and age) and the incidence of stroke have been reported in literatue.[8]

Based on the information above, shows that ischemic stroke is still a serious problem that contributes to the highest cause of death in the world, therefore information related to ischemic structure is very important to be analyzed. This article will present information on the results of ischemic stroke analysis specifically in 34 provinces in Indonesia. The purpose of this study was to analyze GBD 2018 Ischemic Stroke research data in

Indonesia. Data analyzed were deaths, DALYs, YLL and YLD due to ischemic stroke. Analysis aims to determine the value of death, YLL and YLD ischemic stroke due to metabolic factors and the influence of sex and metabolic factors on the value of DALYs Ischemic Stroke.

Material and Methode

Study Design

This type of research is quantitative with cross-sectional design. The data analyzed were sourced from secondary data from Global Burden of Disease research provided by Health Metric International. This study was conducted in 2018 with Ethical Clearance no: LB.02.01/2/KE.086/ 2018.

Data Source

To understand the epidemiological aspects of disease in various parts of the world, including Indonesia, GBD researchers developed statistical tests to estimate the global burden of 291 diseases in all countries divided into 21 groups.[10] The GBD database is managed by the Institute for Health Metrics and Evaluation at the University of Washington in Seattle, Washington, USA (http://www.healthdata.org).

Data sources used to build the GBD database include representative national surveys, cancer registration, vital records systems, and health service usage data and covering 291 diseases in all countries in the world separated into 21 groups.[10] Information about GBD data can be found at GBD Data Input Source Tool at GHDx (http://ghdx.healthdata.org/gbd-results-tool). This tool allows users to explore input sources to GBD based on various criteria, and to export and explore the results. The GBD database is managed by the Institute for Health Metrics and Evaluation at the University of Washington in Seattle, Washington, USA (http: //www.healthdata .org). Therefore, this database provides annual assessments of deaths, years of life lost (YLL) due to premature mortality, years of life with disabilities (YLD), years of life adjusted for disability (DALY).

The GBD study uses a rigorous method to remove bias in the sources and models used to produce estimates based on the epidemiological complexity of the disease. In addition, sophisticated statistical methodologies are used to estimate regional results, thereby reducing sampling bias. The results are updated annually for the entire time series and these results replace the previous version of the GBD study.

Variables studied

The dependent variables examined for ischemic stroke cases were Death, YLL, YLD, and DALYs as a whole in 2017. The independent variables used were sex and metabolite factors, such as high fasting, high systolic, high LDL and high body mass index (BMI).

Data Analysis

Data analyzed were GBD research data in 2018. Subjects in this analysis were men and women who suffered ischemic stroke with 4 metabolic factors. All causes are analyzed from the DALYs, death, YLL/YLD ratio. DALYs were generated by summing YLLs and YLDs. Data were analyzed in addition to descriptively in the form of tables and graphs, an analysis was also conducted to determine the effect between variables using the KrussKall-Walles test. The basis for using the KrussKall-Walles test is because the independent variable is categorized as a scale (gender or type of metabolic disorder) and one dependent variable is on a ratio scale, in addition to that the data between variants of non-homogeneous data groups with homogeneity test results p value <0.05 . The indicators studied are presented in Table 1.

Table 1 Epidemiological indicators, calculations, and interpretation of the results of the indicators[10]

No	Indicator	Calculation	Interpretation
1	Death	No of Death with Specific Case	Proportion of people who die of a Stroke Iskhemik
2	DALYs	Disability Adjusted Life Years adalah YLL (kematian prematur) + YLD (tahun hidup dengan kondisi disabilitas).	Years of healthy life lost
3	YLL	Year life Loss adalah Number of deaths x standard life expectancy at the age of death	The number of years a person could have lived if the illness that killed him had not occurred
4	YLD	Year Life With Disability adalah Number of incident cases x weight of disability x average duration until remission or death	The number of years that an individual lives with a functional impairment caused by an illness

Results

The results of Ischemic Stroke analysis in 34 provinces in Indonesia, according to the results of the 2018 GBD research, were analyzed based on sex and metabolite factors. Four metabolic factors analyzed were high fasting, high systolic, high LDL and high BMI.

Table 2. Descriptive Statistics
DALYS Ischemic Stroke Cause by Metabolite Factors11

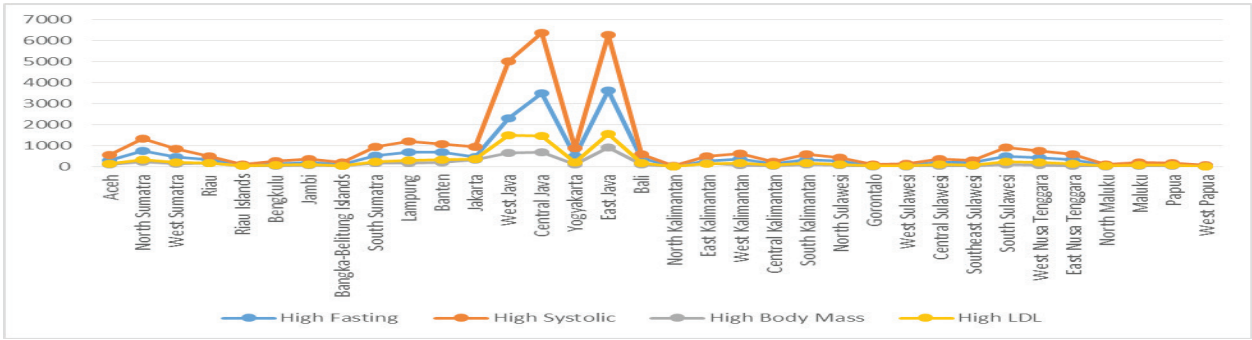
Gender	Factors Metabolite	Mean	Std. Deviation	95% Confidence Interval	
				Lower Bound	Upper Bound
Male	DALYs High Fasting	12269.57	18642.33	408.88	81434.71
	DALYs High Systolic	22718.19	35527.78	765.71	143440.73
	DALYs High BMI	4810.13	6638.33	305.33	28987.46
	DALYs High LDL	7232.70	10850.80	254.5	42249.72
Female	DALYs High Fasting	10386.29	14912.19	206.49	62030.5
	DALYs High Systolic	21078.25	32385.62	365.28	130306.99
	DALYs High BMI	5230.10	6885.30	175.23	27867.73
	DALYs High LDL	6948.81	10007.43	145.95	38185.21

The average value of DALYs in men is greater than women. The mean value of DALYs high systolic is the highest. This can be interpreted as ischemic stroke sufferers who have high systolic have a measure of the loss of life years due to the inability to move to early death due to illness which is the biggest among the 3 other metabolite factors. The next metabolite factor with a high DALYs value are high fasting, high LDL and high BMI.

The Kruskal-Wallis test results has no gender effect on the value of DALYs for Ischemic Stroke. This is known by the value of p = 0.845> 0.05. The high metabolite factors influence DALYs ischemic stroke. This is known by the value of p = 0,000 <0.05. The average mortality rate with metabolite factors is 489.03 (3.23 - 7170.45). The average YLL value is 9226.00 (71.32 - 120615.36). The average YLD is 2108.30 (57.98 - 26868.13). The average ratio of YLL to YLD is 4.74 (0.86 - 7.70).

Graph 1. Death in Men Ischemic Stroke

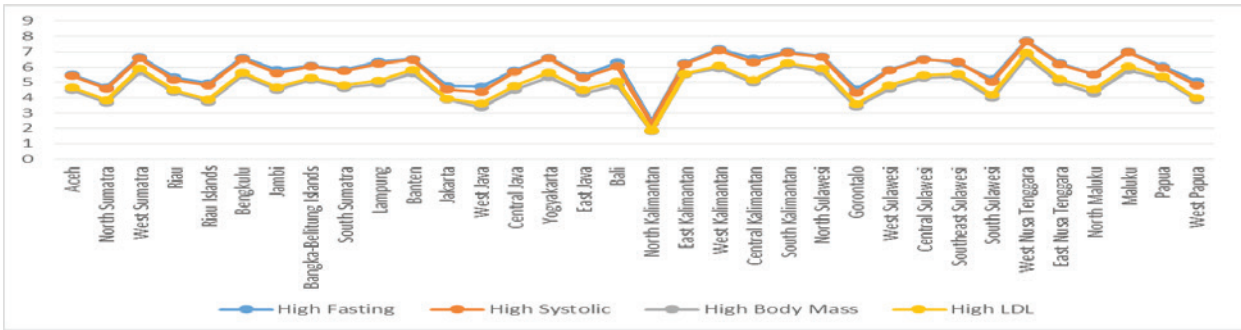
Causes by High Metabolites in 34 Provinces of Indonesia[11]



Based on graph 1, the three highest provinces of ischemic stroke mortality in men population were West Java, Central Java and East Java Provinces. Three provinces of Gorontalo, West Papua, North Kalimantan have the smallest ischemic stroke mortality due to high fasting, high systolic, high LDL. Whereas the 3 provinces that have the smallest ischemic stroke mortality with the causes of high body mass index were Gorontalo, North Kalimantan and North Maluku.

Graph 2. YLL/YLD Ratio in Men with Ischemic Stroke

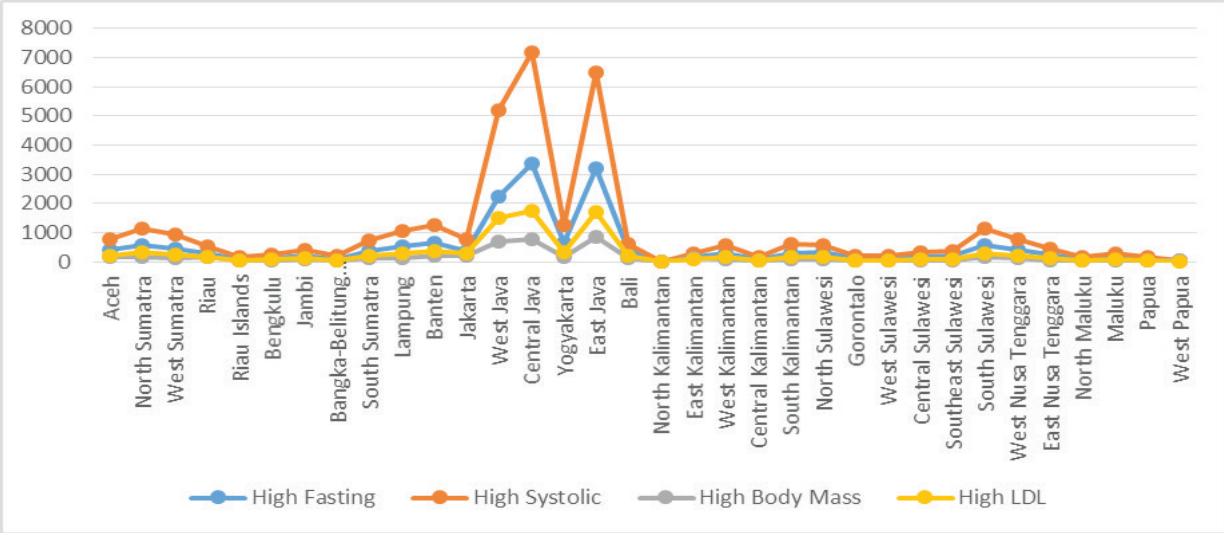
Causes by High Metabolites in 34 Provinces of Indonesia[11]



Based on chart 2, the three highest provinces of the YLL/YLD ratio of ischemic stroke in men population with high fasting and high systolic factors were West Nusa Tenggara, West Kalimantan, Maluku Province. The three provinces with the highest YLL/YLD ratio of ischemic stroke in men with factors that cause high body mass index and high LDL are West Nusa Tenggara, West Kalimantan, South Kalimantan. While the three provinces with the lowest YLL/YLD ratio of ischemic stroke in men with factors that cause high Body Mass Index, high systolic, high LDL are West Java, Gorontalo, North Kalimantan. The three provinces with the lowest YLL/YLD ratio of ischemic stroke in men with high fasting factors are Gorontalo, North Kalimantan, North

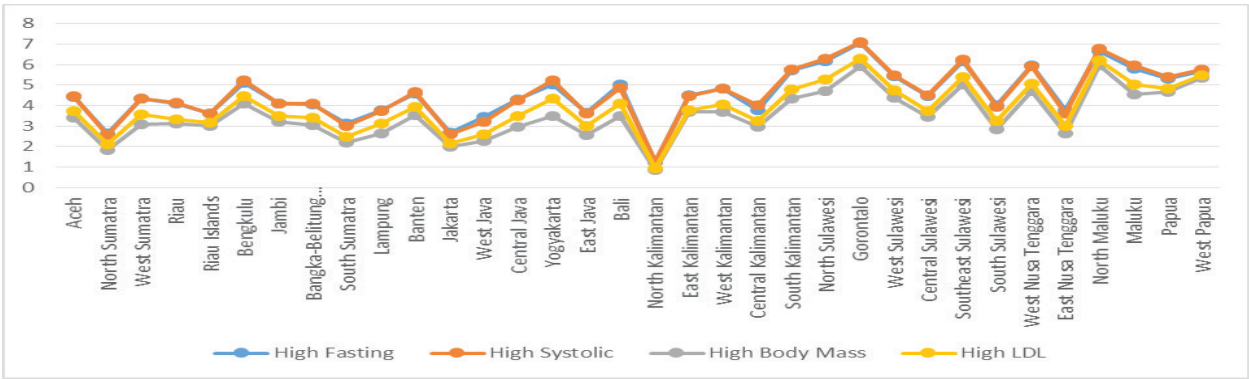
Sumatra.

Graph 3. Death in Women with Ischemic Stroke Causes by High Metabolites in 34 Provinces of Indonesia[11]



Based on chart 3, the three highest provinces of ischemic stroke mortality in women in all (4) high metabolite factors are West Java, Central Java and East Java Province. Three provinces of Riau Island, West Papua, North Kalimantan have the smallest ischemic stroke mortality due to high fasting, high systolic, high LDL. Whereas the 3 provinces that have the smallest ischemic stroke mortality with the causes of high BMI are West Papua, North Kalimantan and North Maluku Provinces.

Graph 4. YLL/YLD Ratio in Women with Ischemic Stroke Causes by High Metabolites in 34 Provinces of Indonesia[11]



Based on graph 4, the three provinces with the highest YLL/YLD ratio of ischemic stroke in women with factors that cause high Body Mass Index and high LDL are Gorontalo, West Papua, North Maluku provinces. The three provinces with the highest YLL/YLD ratio of ischemic stroke in women with the factors that cause high fasting are Gorontalo, Southeast Sulawesi, North Maluku. The three provinces with the highest YLL/YLD ratio of ischemic stroke in women with the factors that cause high fasting are Gorontalo, North Sulawesi, North Maluku. Whereas the three provinces with the lowest YLL/YLD ratio of ischemic stroke in men in all (4) high metabolite factors are the provinces of Jakarta, North Sumatra, North Kalimantan.

Discussion

This study resulted in the value of DALYs ischemic stroke in men is higher than women but statistically there was no effect of sex on the value of ischemic stroke DALYs. Different results based on the 2013 GBD

study which identified a significant difference in stroke burden between men and women.[12] Stroke burden by sex and stroke type, higher epidemiological indicators were observed between men compared to women.[10] Other studies conducted by Jhonson, et al also stated the DALYs value of female strokes was lower than men.[13] This study also produced higher ischemic stroke mortality in men. Other studies in line suggest fewer women die from stroke (2.6 million [2.5-2.7] deaths) than men (2.9 million [2.8 - 3.0] deaths).[13] A study at 2013 stated that the proportionate contribution (%) of stroke-related deaths to deaths from all causes in women was greater than in men.[12]

Based on 2017 GBD data processing, ischemic stroke was significantly influenced by 4 metabolite factors. Other research also states that the majority of stroke DALYs (88.8% [95% UI 86.5 - 90.9]) can be associated with risk factors measured in GBD; this percentage is similar for both types of stroke. Metabolic risk (high systolic blood pressure, high body mass index, high fasting plasma glucose, high total cholesterol, and low glomerular filtration rate) accounts for 72.1% (66.4 - 77.3) DALYs stroke.[13]

Another important finding is the positive and significant relationship between diabetes mellitus and the incidence of stroke, especially the ischemic subtype.[17] According this, 36% of all stroke patients are diabetic. Also, the risk of ischemic stroke is 47% higher than hemorrhagic stroke in diabetic patients.[14] Hyperglycemia is positively related to the functional outcome of acute ischemic stroke.[15] The prevalence of MetS as well as hyperglycemia and dyslipidemia in the infarction group are significantly higher than in the non-stroke group.[16] Mortality Diabetes and global glucose intolerance are the third critical risk factors for stroke mortality in 2017.[17]

The highest value of DALYs ischemic stroke was high systolic. Other studies also state that hypertension is a major risk factor for stroke, both ischemic and hemorrhagic.[18] Other studies state that although the most frequent risk factors in both subtypes stroke were hypertension, the chi-square test shows that this result is not statistically significant (P> 0.05).[14] This study also found that the number of ischemic stroke mortality with the highest causes was high systolic. Recently, a prospective study of 50,000 adults in Golestan showed a positive relationship between hypertension and stroke mortality.[19] In 2017, high systolic blood pressure and dietary risk are the leading causes of death from stroke and world burden.[17]

The effect of high BMI on ischemic stroke was also found in research conducted by Bal SS, et al. States that central obesity and dyslipidemia (increased TG, decreased HDL-C and increased LDL-C) will increase the development and progress of cerebrovascular atherosclerosis, especially diseases occlusive large arteries.[20] Takahashi, et al. stated that there was a significant correlation between increased waist circumference of stroke patients and the prevalence of risk factors for hypertension, hyperglycemia and dyslipidemia.[16] Mortality due to high BMI in ischemic stroke patients ranks fourth among 4 metabolic causes. Other studies have also found obesity globally to be the fourth most influential indicator of stroke mortality.[17]

Research that also states the relationship of dyslipidemia with stroke was carried out by Habibie, et al. Their study found that dyslipidemia was strongly associated with the incidence of total stroke (P <0.05).[14] Recently, the Strong Heart Study (2017) revealed that low density lipoprotein cholesterol levels equal to or greater than 130 mg / dl provided a risk higher ischemic stroke, but interestingly, individuals with high triglycerides and low density high lipoprotein levels who also suffer from diabetes show an incidence of ischemic stroke more than 2 times higher.[21] The mortality rate due to high LDL in ischemic stroke patients ranks third among 4 metabolic causes. Other research also states Hypercholesterolemia, specifically high LDL-C, globally being the eighth most important indicator of death from stroke in 2017.[17]

YLL/YLD ratio values are greater than 1 for all metabolite factors. This ratio indicates that the YLL value dominates the DALYs value. This can be interpreted that the year of life lost due to ischemic stroke is greater than the value of the year of life lost due to disability. The value of the ratio of men is greater than in women. This study is in line with the results in the GBD1990 study and the GBD2000 study, which is about four-fifths of DALY because of YLLs.[22] In this study the YLL number in ischemic stroke men is higher than in

women. Consistent research conducted by Matos, et al who stated that the YLL number strengthens the thesis that men still lose many years of life due to ischemic stroke.[4]

Nearly half of stroke-related deaths may be caused by modifiable risk factors (ie hypertension, diabetes, dietary risk, impaired glucose intolerance, obesity, smoking, air pollution, alcohol use, hypercholesterolemia, and lack of physical activity), which partly large is the result of poor clinical management, limited access to health care, and late detection of the underlying risk factors.[17] The high burden of stroke worldwide indicates that primary prevention strategies are not widely applied or are not effective enough. In addition to targeting behavioral risk factors, effective screening for conditions that increase stroke risk, such as hypertension, atrial fibrillation, and diabetes mellitus, is very important.[13] Stroke prevention is a complex medical and political problem, there is strong evidence that stroke prevention needs to be done. The need to increase action is very urgent. Stroke prevention has entered a new era and is one of the priority NCDs in WHO.[12]

Conclusion

Kruskal-Wallis test results on gender showed no effect on DALYs of Ischemic Stroke but four factor of high metabolites affected to DALYs. The value of the burden (DALYs, Death, YLL/YLD ratio) ischemic stroke in men is greater than women. This occurs in all metabolite factors.

Metabolite factors with the highest ischemic stroke load values of the highest are high systolic, high fasting, high LDL and high Body Mass Index. The high death value in an area does not make the area will have the highest ratio YLL/YLD. The ratio are greater than 1 for all metabolite factors. It indicates that the YLL value dominates the DALYs value. It can be interpreted that the year of life lost due to ischemic stroke is greater than the value of the year of life lost due to disability. The value of the ratio of men is greater than in women.

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