

Public Perspective on Hyperlipidemia Drugs and Sentiments About Hyperlipidemia on Twitter

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Abstract

Hyperlipidemia is a non-communicable disease (NCD) caused by several factors, such as a person's socioeconomic status, culture, customs, habits, and lifestyle. Through user interaction on social media, we can discover the model anti-hyperlipidemia by extracting information, complaints, suggestions, and calls for help about the treatment, which will play a role as an intervention to reduce hyperlipidemia in Indonesia. This study aimed to identify factors influencing perceptions of hyperlipidemia drugs and resulting sentiment on the social media platform Twitter. This study used user-uploaded tweet data to compare perceptions of hyperlipidemia drugs in 2020 and keywords for hyperlipidemia terms and medicine. Tweets related to anti-hyperlipidemia were extracted by issuing tweets containing advertisements, news, re-tweet, and content outside of health. The tweet data obtained was then carried out through content analysis, including point of view, theme, and sentiment analysis, to identify whether the resulting tweets are positive, neutral, or negative using the Support Vector Machine (SVM) method. We identified 1572 hyperlipidemia-related tweets and 153 specific tweets describing hyperlipidemia medications. Tweets about anti-hyperlipidemia showed 99 tweets from the first-person perspective, 23 from the second-person perspective, 22 from healthcare professionals, and nine unidentifiable (other). Sixty-three tweets talked about the benefits of lipid-lowering drugs, 17 complaint tweets, 49 suggestion tweets, 17 question tweets, and two side effect tweets. Assessing public perceptions and sentiment toward hyperlipidemia treatment can be used to develop strategies to increase treatment adherence, improve treatment outcomes, and target health promotion efforts.

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INTRODUCTION

Non-communicable diseases (NCDs) account for 80% of deaths worldwide, and over half of these occur in people under 70 years of age¹. The first rank of NCDs is associated with cardiovascular disease (heart attack and stroke), followed by cancer and diabetes². A comprehensive strategy for managing cardiovascular disease is necessary to reduce risk factors such as hyperlipidemia, hypertension, diabetes, and smoking³. During the productive age, cholesterol is induced by an unhealthy lifestyle that includes consuming cholesterol-rich foods (fatty meat, chicken skin, fried foods, egg yolks), alcohol consumption habits, smoking habits, and a lack of physical activity⁴. Treatment of hyperlipidemia is done with a combination of drugs and diet to reduce the risk of atherosclerosis⁵. Contributions of this study include the evaluation of the effectiveness of Twitter as a means of comprehensively understanding public opinions regarding the issue of hyperlipidemia drugs to formulate potential strategies for therapeutic adherence, utilization of the potential value of social

media as a data source that can be used to study post market hyperlipidemia drugs to develop adherence rate of drug use, and identifying factors that influence the perception of hyperlipidemia by the public.

MATERIALS AND METHODS

Materials

Crawling Twitter data was accomplished using the Python programming language and the Visual Studio Code application, previously registered with the Twitter developer to obtain the Twitter API (Application Program Interface). This study utilized Twitter data from the Indonesian region from January 1st to December 31st, 2020, by using keywords, terms, and drugs for hyperlipidemia obtained from the results of preliminary studies (Table I). The keywords chosen were derived from the initial sampling. Scraping the tweet data resulted in 11,520 tweets associated with hyperlipidemia and 153 specific tweets regarding hyperlipidemia drugs (Figure 1).

Table I. Mining data keywords.

Category	Keywords
Terms (in Indonesian)	"Hiperlipidemia", "Kolesterol", "Trigliserida", "Lemak", "Lemak darah", "Lipid", "HDL", "LDL"
Hyperlipidemia drugs	Statin, Simvastatin, Lovastatin, Atrovastatin, Fluvastatin, Ezetimibe, Kolestiramin, Kolesevelam, Kolestipol, Niasin, Fibrat, Gemfibrozil

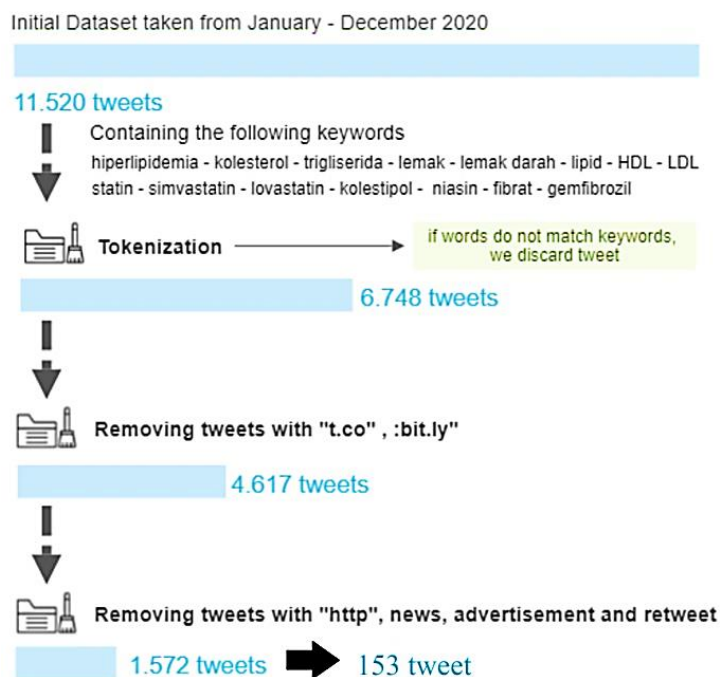


Figure 1. Overview of the different filters applied for the processing of tweets.

Methods

Data processing on Twitter

Tweets scraped from the data resulted in a total of 11,520 tweets, which were received with much noise, so several steps were taken to become research data. The denoising process used computational algorithms (tokenization) to remove tweets unrelated to health and to remove tweets that contain links, news, and advertising elements. The following process was to manually remove retweets and duplicates and generate 1,572 tweets about hyperlipidemic diseases and 153 tweets about hyperlipidemic drugs that met the following criteria:

1. Discuss the experience of the research topic and the experience of treating hyperlipidemia
2. Talk about the research topic, even if it is not a personal experience (family, relatives, friends, or health workers).
3. Discuss individual and community behavior regarding hyperlipidemia medications
4. Tweet in the Indonesian Language.

From a total of 1,559 tweets about hyperlipidemia, 153 tweets were specifically about drugs used to treat hyperlipidemia. We only accept tweets that come entirely from users, as we want to get a clear public perception and not mix them with general portals, news, or advertisements that would later lead to biased results.

Community identification

Qualitative research tends to use smaller research samples, whereas, in this study, population data was used for social media analysis in hopes of providing a picture of the total population of the Indonesian territory. Processed data were next identified based on the views of the tweets and specific themes related to hyperlipidemia treatment and its relationship to lifestyle, as well as other significant information of interest to data processing.

Data analysis

We used a computational algorithm to interpret tweets as positive, neutral, or negative. This procedure was accomplished using the Sastrawi Python Library for stemming (Nazief and Adriani Algorithm) as part of a library instrument. The information gathered was then processed by training with standard words that have positive, neutral, and negative values. This information was then applied to the entire data set. Utilizing a Support Vector Machine (SVM) for sentiment analysis facilitates the process because of the volume of data and reduces individual misconceptions.

RESULTS AND DISCUSSION

Analysis of the identification community

We identified 1,537 hyperlipidemia-related tweets, 1,559 hyperlipidemia-related tweets, and 153 tweets about specific hyperlipidemia drugs for which content analysis will be carried out. Some users write more than one tweet due to the limited number of characters in one tweet. In this study, gender identification was not carried out due to limited identification from the username study. Identification of tweet users' perceptions about hyperlipidemia drugs found that as many as 99 tweet content was tweeted from a first-person perspective (tweets were personal experiences or personal responses of users), 23 tweets came from a second-person perspective (telling family, relatives, or friends' experiences), 22 tweets came from health professionals, and nine tweets could not be identified (others). The tweet content obtained, in addition to using Indonesian, is also partly mixed with regional languages (Javanese, Sundanese, Malay) because Indonesia consists of various tribes and ethnicities⁶. Therefore, this study also included the tweet with the limitation of having the main construction of Indonesian.

Hyperlipidemia drugs used in the community

We identified from the total 153 tweets about our hyperlipidemia drugs that statins are the most widely used in hyperlipidemia therapy (97 tweets), with 88 of them explicitly mentioning simvastatin, one atorvastatin, and eight tweets only mentioning statins in general. Herbs became the drug used with the discovery (31 tweets), followed by the use of supplements (six tweets), others (three tweets), gemfibrozil (two tweets) and colestipol, orlistat (a tweet), and unknown drugs used but mention that using anti-hyperlipidemia drugs (11 tweets) (**Table II**).

Public perception of hyperlipemia drugs

Tweets about hyperlipidemia drugs obtained from Twitter content talked about various things, such as the benefits of using hyperlipidemia drugs. As many as 63 tweets, among the benefits felt, include some accompanying symptoms of hyperlipidemia, such as back stiffness, joints, and dizziness, disappearing after taking drugs. Besides that, consuming antilipidemic drugs can quickly reduce lipid levels in the blood. Complaints about the use of antihyperlipidemic drugs were found in 17 tweets, and the most widely felt complaints were having to take anti-hyperlipidemia drugs because of an unhealthy lifestyle (inability to maintain a diet) and laziness to consume drugs regularly. Advice on taking antilipidemic drugs was found in 49 tweets, advice given to friends or colleagues because they experience some symptoms of hyperlipidemia and advice after consuming foods that are high in cholesterol. There were as many as 17 tweets with inquiries in the body of the tweets about the symptoms of hyperlipidemia and treatment alternatives, both pharmaceutical

and non-pharmacological, talked about with friends and medical experts. Two tweets on the use of antihyperlipidemic medications mentioned their adverse effects, which include feeling weak after taking the medication and reduced sexual function over time.

Table II. Types of hyperlipidemia drugs consumed by the community.

Perception of hyperlipidemia drugs	n tweets	Username	Tweet
Simvastatin	88	@fitria0407	I don't want to lose weight, but I don't want to have cholesterol anymore. This cholesterol has been 2 years, often eat simvastatin. Although the weight is 55kg/163cm. So just convert fat to muscle because muscle weighs more than fat.
Herbs	31	@zain_akmal_	The decoction from sister-in-law, Lime + honey drink, can reduce high blood pressure, cholesterol. It's really good to drink every day in the morning, morning or afternoon, hot heat like this. (I'm a father who gave info in the family wa group :v)
Atorvastatin	1	@iqrzli	Madam, later the medicine for cholesterol is exchanged for this one (atorvastatin) okay? 'Will you finish dinner too?' 'aah(point to the label)' But in the heart it is okay too. The prescription was also yg intervention TD. Intended statin was simvastatin 60mg +amlodipine 10mg Not all statins are created equal
Supplement	6	@silvaniaresty	do not forget triglycerides, Doc. Oh yes, there are herbal supplements that work the same way as statins. Its name is nutrafor chol, it has also been clinical trials by Dr. Aulia Sani at Harapan Kita ☺ Heart Hospital
Gemfibrozil/ Ezetimibe/ Cholestipol	1	@raxnaya	gemfibrozil = decrease in serum TG through PPAR activation ezetimibe = decrease in cholesterol absorption and secretion of bile cholesterol cholestipol = bile acid sequestrant
Orlistat	1	@wkwkwkwkucing	Okay, brother, I just want prevention because I often drink so 🍷🍷 unfortunately if blood glucose can't be cheated like fat using orlistat
Others	2	@syarief78	Greetings uncle,.. If for high blood pressure And cholesterol can baking soda therapy? If possible, how to consume it.. Thanks in advance

Public sentiment regarding hyperlipidemia

This study's sentiment analysis concentrated on hyperlipidemia disease because there were fewer than 153 tweets containing specific data on antihyperlipidemic drugs for SVM analysis. Sentiment analysis of 1,547 tweets about hyperlipidemia was performed using the SVM with term frequency (TF) weighting to analyze the emotions and expressions present in the tweets—public opinion on the disease of hyperlipidemia. Eight hundred fifty-two tweets are considered neutral, 365 tweets are considered unfavorable, and 330 tweets are considered good.

Consumption of antihyperlipidemic drugs in the community

The pattern of hyperlipidemia drug consumption was discovered in 81 tweets, with the majority of individuals consuming anti-hyperlipidemia drugs due to the onset of symptoms or preparations if they consume foods high in cholesterol (44 tweets). In this group, individuals know the risks and dangers associated with unhealthy lifestyles, such as consuming high-fat foods. They are also aware that they have a history of hypercholesterolemia but do not take it too seriously because they have anti-hyperlipidemia drugs on hand. Forty to seventy-five percent of patients who take anti-hyperlipidemia drugs, particularly statins, stopped treatment after approximately one year for a variety of reasons, including age, consumption of multiple drugs, and cost issues⁷. Self-reported reports of treatment adherence can contribute to therapy efficacy⁸. Creating a mobile application (mHealth) as a reminder to consume drugs in short messages (short message services) or web-based applications/android is one way to improve patient compliance in treating cardiovascular disease using information technology. Furthermore, this application can send information about health and the importance of using treatments regularly. The most essential factor, especially for people with hyperlipidemia, is how the application can motivate them to adopt a healthy lifestyle⁹.

People who regularly consume anti-hyperlipidemia drugs are found in 37 tweets. Some of the causes of this routine consumption are high health beliefs against hyperlipidemia, and some of the reasons are because they have experienced poor health conditions due to hyperlipidemia and become obedient to maintain food intake and treatment. Statin drugs (simvastatin and atorvastatin) became the first choice of the public when experiencing hyperlipidemia with the discovery

of 97 tweets about drugs. Statins are the first drugs recommended when associated with hyperlipidemia, either in use or advice. Some considerations that make statins the first choice are supported by two factors: at the micro level, statins are chosen based on patient preferences and medical professional experience (efficacy and side effects), and at the macro level, which is a first-line drug for treating hyperlipidemia and is covered by the Health Social Security Administering Agency, Republic of Indonesia¹⁰. Due to the habit of consuming herbal medicines, regular consumption is additionally observed, and the kinds of herbs used are quite varied, such as garlic, bitter melon, turmeric, and others. Traditional Chinese Medicine (TCM), *Achyranthes aspera*, *Camellia oleifera* Abel., *Piliostigma thonningii*, and others have been used for generations to decrease cholesterol levels, as had other botanicals¹¹.

Hyperlipidemia drugs and their relation to other perceptions in society

Tweets associated with hyperlipidemia drugs are related to other themes because tweets may discuss more than one theme within the same content, for example, tweets from the @sixteen_eight_ account containing:

"Tension has been measured normally at 128/83. This cholesterol level is 245 mg/dL. Gout is typical. Sugar 114 mg/dL. Yesterday, the doctor took Aspilet and 10 mg of simvastatin. It is still painful, but it has already improved slightly. Because you frequently pursue your hair, eh? I have no idea why progeny parents have cholesterol and stroke."

The tweet discussed various topics, including lifestyle by performing health checks, hyperlipidemia medications, specifically simvastatin, complications/comorbidities that typically accompany cholesterol, gout, hypertension, and symptoms, specifically dizziness. In 153 tweets about hyperlipidemia medications, four additional themes were identified: symptoms, lifestyle, complications and expenditures, and government policies.

Drugs with lifestyle

As shown by a total of 61 tweets discussing medication and lifestyle simultaneously, lifestyle is closely related to the treatment of hyperlipidemia. The most common lifestyle issue is health checks (24 tweets), followed by controlled food (17 tweets), which includes avoiding high cholesterol food intake, diet, adequate water consumption, and uncontrolled foods that cause elevated blood lipid levels (14 tweets), exercise (six tweets), and stress/lack of rest (four tweets). According to the tweet, it was found that many people take drugs after learning they have high blood cholesterol levels; therefore, this must be one of the strategies employed by health professionals. The most significant barrier to a healthy lifestyle with regular health exams is a lack of awareness about the importance of preventive care and cost considerations¹². After a person develops symptoms or is diagnosed with diabetes and dyslipidemia, they are more likely to engage in health exams¹³. People's lifestyles are closely related to their culture, such as traditional foods that contain a great deal of oil, coconut milk, and salt, as well as cultural shifts, such as the acceptability of smoking among women, in addition to the rise of fast food restaurants or other unhealthy foods in the community due to the ease of obtaining them¹⁴. Unhealthy food is the most common factor found in unhealthy lifestyles. Therefore, this must be a concern, especially for the Indonesian government¹⁵.

Drugs with symptoms

Many Indonesians use symptoms as indicators of hyperlipidemia and will take medication if they experience symptoms such as dizziness, neck tension, and discomfort in specific areas of the body. In the tweet data, five tweets were found that discussed symptoms and medications, such as @retnokristiany's tweet:

"Humm, wrong pillow or what? Sister, isn't it shoulder-neck shampoo? If so, it can be cholesterol :(This can be taking simvastatin, taken at night, going to bed, and not eating anymore, or if it's just a migraine and makes you feel bad in the body, just drink mefenamic acid."

Symptoms continue to be one of the determining factors for a person to take anti-hyperlipidemia drugs or anti-hyperlipidemia drugs in combination with other drugs, as indicated by this tweet.

Drugs with complications

Twenty-two tweets included both drug and complication mention, with hypertension (11 tweets) being the most frequently discussed comorbidity. Other comorbidities discussed include cardiovascular disease (five tweets), hyperglycemia (two tweets), heart, obesity, and stroke (one tweet). Cardiovascular diseases like hyperlipidemia, hypertension, and diabetes are risk factors for cardiovascular disease, stroke, and osteoporosis^{16,17}.

Alternative treatment with herbs for hyperlipidemia

The use of herbal medicine to treat various health conditions has been widespread among the people of Indonesia, also known as "jamu." This practice dates back to before the 18th century, as evidenced by the discovery of fossils in the form of pestle and urine, as well as by reliefs on Borobudur Temple¹⁸. In this study, it was determined that public consumption of herbal medicine was sufficient to surmount hyperlipidemia, as evidenced by the discovery of as many as 31 tweets (21.26%), and that garlic was the herb most commonly believed to lower cholesterol levels, as it was mentioned in six tweets. The use of herbs to treat hyperlipidemia can be a single herb or a combination. The use of these herbs is heavily influenced by the belief that long-term use of conventional pharmaceuticals will have adverse effects on the body. Numerous botanicals have been shown to reduce blood cholesterol levels, including *Pongamia pinnata*, *Acalypha indica* Linn, *Terminalia arjuna*, *Allium schoenoprasum*¹¹, *Persea gratissima* Gaertn, *Hylocereus polyrhizus*, *Annona muricata* L, *Nephelium lappaceum* L, and *Sechium edule* are Indonesian herbal plants that have been studied and proved to reduce cholesterol levels in the blood¹⁹.

Sentiment analysis as a focused health problem management strategy

Sentiment analysis can determine satisfaction levels, formulate strategies, and assess the effectiveness of strategies over time²⁰. Sentiment analysis on social media facilitates the rapid discovery of societal phenomena²¹. Negative sentiments regarding the treatment of hyperlipidemia, such as side effects, adherence, and cost, require special attention because, if not addressed immediately, they can cause social unrest and prevent the achievement of goals. Health promotion is required to encourage individuals to adopt healthy lifestyles²², and promotion will be effective if it focuses on future challenges²³. Focused health promotion can be achieved by treating issues arising from negative perceptions of hyperlipidemia and by utilizing advances in information technology to increase community coverage²⁴. Health employees, especially pharmacists, should be able to use information technology such as social media for campaigns on how to use hyperlipidemia drugs appropriately and health promotion efforts in terms of drug adherence because the use of information technology provides broad coverage at affordable prices is interactive (information in the form of text, images, audio, and video), has a two-way communication function (communication between patients and health workers), and can be used to measure the effectiveness of the campaign. It also serves as a forum for health professionals to share information²⁵.

Limitations and future design

We identified several limitations in this research. First, there needs to be more data that meets the criteria and can be analyzed to provide a summary of the public's perception of anti-hyperlipidemia drugs. There were only 153 tweets explaining the problem of medications for data withdrawal in 2020 out of the total data on hyperlipidemia. More data will be collected by search engine, where active users can locate information about a disease or medication²⁶. Twitter users, particularly in Indonesia, are not yet accustomed to actively discussing treatment conditions or complaints; most tweets are still querying or allegations. The treatment of other non-communicable diseases (NCDs), such as hypertension, gout, and diabetes, is always mentioned alongside tweets about anti-hyperlipidemia drugs. To examine the relationship between hyperlipidemia-hypertension-gout-diabetes treatment, we anticipate that future research will collect data over an extended period and with more detail. The sole purpose of perceptual analysis is to determine how positive, neutral, or negative an individual's emotions are without investigating their relationship with health beliefs. Health beliefs, such as the health belief model, can provide a comprehensive understanding and encourage individuals to actively focus on their level of health knowledge²⁷. The comparison between treatment tweets and health beliefs is a highly effective strategy for enhancing treatment adherence and decreasing the incidence of hyperlipidemia, health promotion, primary prevention, high-risk screening, and early screening²⁸. The information available on social media could be of better quality, necessitating comparison with other sources before use in disease management²⁵. The content of social media is primarily comprised of vague references (without citations) and even misinformation; it concentrates on individual stories. The nature of social media content poses a challenge to the ability of health professionals to provide accurate knowledge/information actively, but it can also serve as a tool for health promotion.

CONCLUSION

Social media can significantly improve the world of health, specifically by analyzing treatment against treatment and managing a post-market survey of a treatment's efficacy due to the development of information technology. Twitter social media can be a source of information regarding treatment and medication adherence, in addition to facilitating communication between health professionals and the community. It is possible to assess public perceptions and attitudes regarding health problems and treatment to formulate strategies and policies to increase adherence to appropriate medications and health promotion to correct misinformation about a disease.

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AUTHORS' CONTRIBUTION

All authors have an equal contribution to carrying out this study.

DATA AVAILABILITY

None.

CONFLICT OF INTEREST

The findings and conclusions in this report are from the author and do not represent the official position of any institution.

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