Pineapple (Ananas comosus) Niacin Extract’s Effect on Total Cholesterol and Triglyceride Levels in Hypercholesterolemia Wistar Rats

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Abstract

Dyslipidemia—or hypercholesterolemia—occurs when the body’s cholesterol levels are abnormally high and is brought on by the unhealthy lifestyle. Anyone, regardless of age or gender, can have hypercholesterolemia. Still, it can be treated with high-fiber diets like those found in fruits, vegetables, and other foods. Pineapple (Ananas comosus), which has a lot of vitamins and fiber from the leaves to the cob, is one source of plant fiber. Niacin, one of the chemicals found in pineapple, can reduce blood cholesterol levels. This study examined the potential effects of pineapple (Ananas comosus) extract on total cholesterol and triglyceride levels in hypercholesterolemic wistar rats using article reviews from 2010 to 2020. The approach that was used was a systematic review. The study revealed that pineapple extract (100/mg/Kg B.W.) can decrease total cholesterol and triglyceride levels in hypercholesterolemic rat models. The total cholesterol and triglyceride levels in rats will fall even near normal levels if the dose increases.

Keywords: Pineapple (Ananas Comosus), Cholesterol, Triglycerides, Niacin

INTRODUCTION

In this modern era, health problems have shifted from infectious to degenerative diseases. One of the causes is thought to be due to diet, stress and environmental factors, lifestyle changes, and lack of physical activity (exercise). Consumers eat foods that are not maintained, such as lots of fat and cholesterol and
a lack of high-fiber intake (which comes from vegetables and fruit) coupled with a lack of activity or exercise; then this can trigger degenerative diseases (Yani, 2015). Cardiovascular disease is a degenerative disease that significantly affects the number of deaths and health rates.

Lack of activity coupled with eating habits that are not good, fatty foods, oily foods, and unhealthy lifestyles can trigger hypercholesterolemia. Unbalanced food references consuming foods with high levels of fat and carbohydrates but consuming foods with low fiber, eating fast food, and using cigarettes and drinking alcohol. As a result of high cholesterol levels in the body, the absorption and synthesis of cholesterol will also increase if you consume foods that are too high in fat and carbohydrates (Yani, 2015). Reducing the consumption of fatty foods and even having to choose foods with low fat and multiplying vegetable and fruit foods (containing lots of fiber) and advised to do regular exercise routines is an effort to reduce cholesterol levels in a person from high values to normal values.

In adulthood, patients with hypercholesterolemia are generally found. The value of cholesterol levels has increased in the male group from the age of 35 to the age of 50. Quoting from Research conducted in Thailand in 2006 showed that around 22.8% at the age of 30-39 years found hypercholesterolemic sufferers were dominated by men, 25.6% at the age of 40-49 years, and aged 50-59 year of 20.9% (Yani, 2015).

Reducing cholesterol in an individual of a certain age with hypercholesterolemia by strictly reducing consumption of fat and cholesterol is not very significant. Increasing the consumption of high dietary fiber (dietary fiber) is an effort to lower cholesterol levels in the blood. A high-fiber diet inhibits the absorption of fat/cholesterol in the small intestine, subsequently reduces cholesterol levels in the blood plasma, and increases cholesterol synthesis by bile synthesis, liver, and cholesterol excretion through feces. Therefore, dietary fiber is highly recommended and even recommended by doctors as well as most that dietary fiber can keep cholesterol levels within normal limits (Hernawati and Wasmen, et al., 2013).

Several fibrous foods contain polysaccharides, oligosaccharides, lignin, and other plant substances. There are two types of dietary fiber: insoluble dietary fiber
and soluble dietary fiber. Sources of insoluble fiber come from cellulose, hemicellulose, and lignin, which are obtained from various types of nuts, cereals, vegetables, and fruit. In contrast, soluble dietary fiber is obtained from pectin, gum, agar agar, alginate, carrageenan, and mucilage. The fibrous parts of food have several different physiological properties related to the shape and chemical properties of the fiber (Hernawati and Wasmun et al., 2013).

One of the intakes of fiber from vegetable sources is pineapple. The fruit that is usually liked by people, both locally and internationally, is the Ananas Comosus fruit. The fruit has parts that are usually discarded (not eaten), including the skin, which has an irregular shape. Then there are also small thorns which are located on the outer surface. Pineapple peels contain vitamin C, carotenoids, and flavonoids, but most people throw them away as waste (Erukainure et al., 2011). Several plant derivatives that have the ability and benefits as antioxidants and anti-carcinogens contain phenolic phytochemicals such as phenolic acids, flavonoids, tannins, and lignins and non-phenolics such as carotenoids and vitamin C. In addition, phenolic compounds have been proven to reduce serious diseases such as the risk of cancer, coronary heart disease, stroke, atherosclerosis, and inflammation associated with oxidative stress.

The fiber content found in pineapples is useful for lowering blood cholesterol levels and reducing the risk of diabetes and heart disease, as well as helping metabolic and digestive processes. The dietary fiber content of 150 grams of pineapple is equal to half that of an orange. In addition, pineapple fruit is a good source of nutrients for vitamin C and various other vitamins. Antioxidants are abundant in fruits can also be found in pineapple, namely chlorogenic acid. This acid inhibits the formation of substances that can trigger cancer, namely nitrosamines (Bintar, 2011).

Other researchers have conducted various Research by choosing the fruit extract and pineapple fruit juice method. Referring to this background, the Research is in the form of a literature study with the title "Pineapple (Ananas comosus) Niacin Extract's Effect on Total Cholesterol and Triglyceride Levels in Hypercholesterolemia Wistar Rats."
METHODE

The research method used is to conduct a literature search through journal reviews for the 2010-2020 period using a systematic review.

Figure 1. Research Prism Diagram: Electronic Database Search Scheme The journal selection process is carried out by identification, screening, due diligence, and inclusion methods

RESEARCH RESULT

Based on the results of research journal searches that have been carried out by several researchers who used pineapple extract on total cholesterol and triglyceride levels in white Wistar rats made hypercholesterolemia, a comparison table of results was obtained by several studies as follows:
Table 1. Research Results by Moinul et al., Latifa et al., Hijazi et al., and Inam et al. related to the effect of pineapple extract (Ananas Comosus) on Total Cholesterol and Triglyceride Levels in Hypercholesterolemic Wistar Rats (Rattus Novergicus).

<table>
<thead>
<tr>
<th>No</th>
<th>Author</th>
<th>Years</th>
<th>Extract Type</th>
<th>Treatment</th>
<th>Total Cholesterol Levels (mg/dl)</th>
<th>Triglyceride Levels (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moinul, I., et al</td>
<td>2011</td>
<td>Pineapple Extract</td>
<td>K-/ Negative control</td>
<td>61.74 ± 3.57</td>
<td>64.31 ± 3.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>K+/ Positive control</td>
<td>167.38 ± 5.2 (171.1%↑)</td>
<td>134.54 ± 3.63 (109.2%↑)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P1 (100 mg/kg BB Rats)</td>
<td>92.02 ± 4.18 (42.02%↓)</td>
<td>68.49 ± 9.09 (49.09%↓)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P2 (500 mg/kg BB Rats)</td>
<td>88.10 ± 5.07 (47.36%↓)</td>
<td>55.54 ± 5.63 (58.7%↓)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P3 (1000 mg/kg BB Rats)</td>
<td>63.50 ± 3.22 (62.06%↓)</td>
<td>50.11 ± 4.45 (62.75%↓)</td>
</tr>
<tr>
<td>2</td>
<td>Latifa., et al</td>
<td>2013</td>
<td>Pineapple Extract</td>
<td>K-/ Negative control</td>
<td>61.74 ± 3.57</td>
<td>64.31 ± 3.57</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P3 (1000 mg/kg BB Rats)</td>
<td>63.50 ± 3.22 (62.06%↓)</td>
<td>50.11 ± 4.45 (62.75%↓)</td>
</tr>
<tr>
<td>3</td>
<td>Hijazi, A., et al</td>
<td>2016</td>
<td>Pineapple Extract</td>
<td>K-/ Negative control</td>
<td>143.83 ± 3.49c</td>
<td>74.50 ± 1.80c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>K+/ Positive control</td>
<td>397.66 ± 9.50a</td>
<td>132.16 ± 2.35a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P1 (250mg/kg BB Rats)</td>
<td>146.66 ± 1.25b</td>
<td>78.83 ± 1.79b</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>P2 (500mg/kg BB Rats)</td>
<td>142.50 ± 3.64c</td>
<td>76.83 ± 2.34c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P3 (750 mg/kg BB Rats)</td>
<td>143.00 ± 2.04c</td>
<td>79.66 ± 2.30b</td>
</tr>
<tr>
<td>4</td>
<td>Inam, M., et al</td>
<td>2019</td>
<td>Pineapple Extract</td>
<td>K-/ Negative control</td>
<td>142.50 ± 3.01</td>
<td>65.45 ± 2.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>K+/ Positive control</td>
<td>223.13 ± 9.22</td>
<td>129.34 ± 8.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P1 (600 mg/kg BB Rats)</td>
<td>174.81 ± 3.67</td>
<td>81.10 ± 3.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P2 (900 mg/kg BB Rats)</td>
<td>161.50 ± 4.50</td>
<td>76.34 ± 5.39</td>
</tr>
</tbody>
</table>
The results of some of the studies summarized in a table state that not all of the research results are listed in full, as was the case by Latifa et al., 2013 where the research results were incomplete and clear regarding the effect of pineapple administration on total cholesterol levels in white rats dyslipidemia/hypercholesterolemia males, the researcher only included a calculation formula to determine total cholesterol levels through the equation determined by the researcher without providing information about total cholesterol levels in the normal group and dyslipidemia/hypercholesterolemia group.

While the results of Research by Moinul et al., 2011 are complete results and discussion of Research, they are also easy to understand because, in the study by Moinul et al. 2011, the effects of Total Cholesterol, Triglycerides, High-Density Lipoprotein (HDL) and Low-Density Lipoprotein (LDL) were included. Also, the percentage increases and decreases in total cholesterol and triglyceride levels and HDL - LDL.

Then the Research conducted by Hijazi et al., 2016 is the same study as that by Moinul et al. 2011, but there are differences in the doses of pineapple extract they give; also, the results of the study discussion are not complete like previous Research by Moinul et al. 2011.

Inam et al., 2019's Research differs from the previous Research; the researcher conducted two experiments at once by comparing pieces of dried pineapple and pineapple extract. The research results also only used two experimental samples for each treatment. However, when writing the manuscript, the data used was pineapple fruit extract on white Wistar rats, which were made hypercholesterolemic. The following is a bar chart on the results of Research by Moinul et a.,/2011 regarding pineapple extract (percentage of pineapple extract).
Figure 2. Research diagram number 1 by Moinul et al., 2011

The following is a diagram of the results of Research by Latifa et al., 2013 regarding pineapple extract (percentage of pineapple extract). In Table 1, Comparison of Research Results Number

Figure 3. Research diagram number 2 by Latifa et al 2013
The following is a diagram of the research results by Hijazi et al., 2016 regarding pineapple extract (percentage of pineapple extract). In Table 1. Comparison of Research Results Number 3

![Figure 4. Research diagram number 3 by Hijazi et al. 2016](image)

The following is a diagram of Inam Research et al., 2019 results regarding pineapple extract (pineapple extract levels in percent). In Table 1. Comparison of Research Results Number 4

![Figure 5. Research diagram number 4 by Inam et al. 2019](image)
DISCUSSION

The positive control (K+) and negative control (K-) values are listed in the tables and graphs. K- is when the white Wistar rats are in a normal/healthy state, whereas K+ is when the rats have been treated with a high-fat diet. There is also treatment 1 (P1), treatment two (P2), and treatment 3 (P3) in the treatment groups one, two, and three doses of pineapple extract converted in percent form, with the largest concentration calculated from all of these studies in units of milligrams considered 100%. For example, if the largest concentration in all studies is 60 mg, 60 mg is regarded as 100%. Then if there is a level below that (for example, 40 mg, then make a percent (%) using 60 x 100% = 66.67%) and so on using that calculation.

In a study by Moinul et al., 2011, the effect of pineapple extract on total cholesterol and triglyceride concentrations in white Wistar rats that were made hypercholesterolemia was very clearly marked with significant changes after administration of pineapple extract, as in the first group with a dose of 100 mg/kg B.W. rats. It appears to have decreased by (42.02% in total cholesterol) from the negative control value (after a high-fat diet), namely 167.38 ml/dl. Even at large doses (group three), it can reduce levels in the negative control to close to normal values in the normal white Wistar rat group (positive control).

Based on research, Latifa et al., 2013 the researchers conducted a study on the effect of pineapple extract on total cholesterol and triglyceride concentrations in white Wistar rats with hypercholesterolemia where there was a change in total cholesterol levels in the first group with a dose of 3000 mg/kg B.W. rats after administration of pineapple extract in group one. As the dose increased, total cholesterol and triglyceride levels also decreased.

In research conducted by Hijazi et al., 2016 that the researcher used the pineapple extract method, where the changes were significant and effective in reducing total cholesterol and triglyceride levels in white rats made hypercholesterolemia in the first group, namely with a dose of 250 mg/kg B.W. rats 40.35% to close to normal values in the normal rat group (positive control).

In a study by Inam et al., 2019, a striking difference was found in the average total cholesterol and triglyceride values in the rat group treated with pineapple extract
compared to the hypercholesterolemia group. The highest average values of total cholesterol and triglycerides were seen in the hypercholesterolemic group due to a high-fat diet. Mice treated with pineapple extract (0.6 mg and 0.9 mg) showed the lowest mean values of total cholesterol and triglyceride levels compared to the hypercholesterolemic group.

Based on the results of several studies, it was found that pineapple fruit can reduce total cholesterol and triglyceride concentrations; this is quoted from Moinul et al., 2011 *Ananas Comosus* (L.) Merr. reported having many phytochemicals, especially fiber, such as hemicellulose. Pineapple is also said to have a lot of soluble fiber, such as oats, pectin, etc. (Umashankar 1981). The soluble fiber was reported to reduce cholesterol levels (Lisa et al., 1999). The results of several studies by (Moinul et al. (2011), Ma et al. (2007), and Cho et al. (2010) said that the content of caffeic acid and chlorogenic acid in the ethanol extract of pineapple fruit could reduce triglyceride levels (in plasma, liver, and heart) and total cholesterol concentration (in plasma, adipose tissue and heart). Many studies have mentioned the anti-hyperglycemic and anti-dyslipidemic properties of PLE due to its content of phenolic acids, including p-Coumaric acid, Caffeic acid, and Chlorogenic acid, respectively. Significantly reduced total plasma cholesterol and triglycerides in white Wistar rats (Cho et al., 2010) and Chai et al., (2013).

This can also be attributed to the phytochemicals such as flavonoids present in pineapple extract, which play a key role in inhibiting the activity of lipid metabolism enzymes, namely HMG-CoA reductase is inhibited by 20 to 49% and triggers the synthesis of endogenous lipids (cholesterol and triglycerides). These flavonoids also accelerate the lipoprotein lipase enzyme (up to 200% to 400%), stimulating fat burning (Xie et al., 2007).

The findings of this study are in by Bahnasy and Yassin (2015), who described that obese-hyperlipidemic rats showed a significant decrease in total cholesterol and triglyceride levels when given a diet with the addition of dried pumpkin and dried pineapple.

The results of the research tabulation are also to the effects of Hijazi et al. (2016), who described that the phenolic compounds contained in pineapple extract,
including caffeic acid, p-Coumaric acid, and chlorogenic acid, exhibit hypercholesterolemic and hypolipidemic features by lowering total cholesterol and triglyceride levels in plasma, heart, liver and adipose tissue. Moinul et al., 2011 revealed that phytonutrients (flavonoids), dietary fiber (hemicellulose), and soluble fiber (pectin and oats) are very helpful in lowering T.C. and T.G. levels.

**CONCLUSION**

Ethanol extract from pineapple fruit has the potential to reduce total cholesterol and triglyceride levels in white Wistar rats which are made hypercholesterolemic at a more effective and significant dose, namely at a level/dose of 100 mg/kg B.W. rats

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