Test Of The Effectiveness Of Giving Aloe Vera Extract In Reducing Cholesterol In Male Wistar Rats (Rattus Norvegicus) With Hypercholesterolemia

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Abstract.

Obesity prevention can be done with diet and exercise. Since plasma cholesterol levels are associated with diabetes, public interest in diabetes treatment in foods and herbal medicines has increased dramatically. This research wants to confirm and maximize topical plant treatment and diabetes medication benefits. This study employs a lab experiment. Aloe vera was examined for cholesterol-lowering capacity in hypercholesterolemic male Wistar rats (Rattus Norwegian) utilizing a pre-test-post-test control group. Aloe vera extract (Aloe vera) reduces cholesterol, body weight, and LDL in hypercholesterolemia-afflicted male Wistar white rats (Rattus norvegicus). One-way ANOVA test results show a significant value of 0.000 or less than 0.05. These statistics show a substantial difference between the control and treatment groups. This study's Post Hoc LSD test analysis indicated significance values of 0.000 and 0.018 or less than 0.05, indicating that all groups differed. Aloe vera extract reduces LDL significantly, and the group with a concentration of 4.5% reduced LDL levels more than the other groups in Wistar male white rats (Rattus norvegicus) with hypercholesterolemia.

Keywords: *Aloe Vera, Hypercholesterolemia and Cholesterol.*

I. INTRODUCTION

Healthy living appears simple in principle. Simple lifestyle changes are needed to balance activity, nutrition, sociability, and rest. Unfortunately, it's rarely that easy. Life's stressors, such as working, raising a family, and living in a screen-time, fast-food culture, might prohibit us from making healthy choices. Modern life promotes high-calorie processed and quick food. Too many unhealthy foods induce obesity [1], [2]. Excess bodily fat causes obesity. This scenario produces health issues for adults, teens, and children in industrialized and developing countries. Today's society is plagued by obesity, which has skyrocketed worldwide.Equilibration between food energy and body energy creates energy balance. Adipose tissue, physical activity, or heat can store excess dietary energy. In obesity, energy imbalance promotes insulin resistance, type II diabetes, retinopathy, neuropathy, nephropathy, and cardiopathy [2]–[4]. Obesity can be central, with most fat tissue in the intra-abdominal region, or peripheral, with fat mainly in the femorogluteal part. This gender- and race-based distribution mixes in infancy and affects quality of life.Obesity is connected to genetic vulnerability, demographic characteristics (age, gender, education, and income), and lifestyle factors. Inactivity is known to cause weight gain. Research links physical exercise intensity to abdominal obesity [5]–[8]. Up to a point, cholesterol is healthy. Many disorders are linked to high cholesterol. Our risk of heart disease increases with LDL cholesterol levels. People with more elevated HDL cholesterol have a lower risk of heart disease [9]–[11]. A mismatch in energy intake and expenditure raises blood cholesterol and causes hypercholesterolemia. Hypercholesterolemia is characterized by blood cholesterol levels ≥ 200 mg/dL [1], [5].

When extra adipose tissue occurs in the upper chest or abdomen, obesity is linked to insulin resistance, abnormal lipid metabolism, and metabolic syndrome. The majority of the consequences of obesity on cardiovascular disease are attributable to dyslipidemia, diabetes, hypertension, inflammation, and procoagulation. The majority of high BMI deaths come from cardiovascular disease [12], [13].Dyslipidemia affects 60-70% of obese people. Obese patients have elevated triglycerides, VLDL, apolipoprotein B, and non-HDL-C. VLDL synthesis in the liver and impaired clearance of triglyceride-rich lipoproteins raise blood triglycerides. High serum triglycerides and low HDL-C are typical. Dense LDL increases slightly, although LDL-C levels are usually normal. Fat patients are at higher risk of cardiovascular disease. Hence,

dyslipidemia therapy is generally recommended. Weight loss lowers triglycerides and LDL-C and raises HDL-C [11], [14].As macrophages invade adipose tissue, obesity causes inflammation. Lipid metabolism is regulated by macrophage and fat cell cytokines and adipokines, including adiponectin and resistin. Circulating adiponectin is lower in obese people. Low adiponectin levels raise serum triglycerides and lower HDL-C. This association is assumed to be causal since transgenic mice with overexpressed adiponectin had lower triglycerides and higher HDL-C levels, while knock-out mice have the opposite. Catabolism of triglyceride-rich lipoproteins is boosted by lipoprotein lipase activity and inhibited Apo C-III, an inhibitor of lipoprotein lipase, by adiponectin. Adiponectin enhances HDL-C levels by increasing hepatic Apo A-I and ABCA1, which improves HDL particle formation [11], [13]–[16].

Obesity increases the risk. A mismatch in energy intake and expenditure raises blood cholesterol and causes hypercholesterolemia [13], [17]. Hypercholesterolemia is characterized by blood cholesterol levels ≥ 200 mg/dL. High blood cholesterol causes significant health issues if untreated. Therefore, you must immediately restrict your food and exercise to address this illness.Obesity prevention works with diet and exercise. Because plasma cholesterol levels are linked to heart disease, public interest in dietary cholesterol has grown dramatically. Since 20-25% of our cholesterol originates from animal foods like eggs, meat, dairy, etc., it's crucial to know our food's cholesterol content. Laboratories must offer food manufacturers nutrition information for proper labeling to educate consumers about healthy foods and food choices to decrease nutrition-related diseases. Accurate cholesterol content measurement in meals is crucial and stimulates cholesterol quantification technology development [5], [13], [14], [16].Playing sports is another option. Regular exercise maintains cognitive function, according to research. Many people cannot exercise regularly due to time or physical difficulties [18]. Identifying additional ways to attain equal, or even better, health impacts as exercise is crucial. We believe Aloe vera extract has the desired effects [19]–[22].The world's oldest and most frequently used medicinal plant is aloe vera.

Aloe vera is medicinal. Aloe vera helps heal wounds, treat burns, reduce frostbite damage, protect against x-ray skin damage, lung cancer, intestinal problems, increase HDL, decrease LDL, lower blood sugar in people with diabetes, fight AIDS, allergies, and boost the immune system [20], [22]. Over 200 bioactive compounds have been found in aloe vera gel phytochemistry. Aloe vera is sold in thousands of items, including pills, sprays, ointments, lotions, beverages, drinks, jellies, and creams. High cholesterol is reduced with aloe vera. Anti-cholesterol aloe vera contains glucomannan, anthraquinone, folic acid, lipase enzyme, lignin, vitamin B3, and vitamin C [19], [21].The fewer side effects and long-term use of aloe vera as an herbal medication promote its use. Aloe vera oral treatment improves glycoprotein metabolism in diabetic mice and lowers glucose in humans. This plant's phytosterols reduce blood glucose, HbA1c, and serum lipids. Clinical investigations regularly show these results [19], [22], [23]. Polysaccharides, flavonoids, carbohydrates, coumarins, tannins, chromones, alkaloids, anthraquinones, organic compounds, pyrones, phytosterols, antrones, sterols, vitamins, proteins, and minerals are found in aloe vera [19]–[22], [24]. This chemical concentration varies by plant portion, extraction procedure, solvent, growth stage, and plant source.The purpose of this study is to evaluate the efficacy of aloe vera extract in lowering cholesterol levels in hypercholesterolemic male Wistar rats (Rattus norvegicus).

II. METHODS

This study employs a lab experiment. This laboratory experimental research was carried out using a pretest and posttest experimental and control group design [25]. Experimental variables are variables that are related and applied directly to find out what effect they have on specific symptoms [26]. Controlling all external variables is essential to experimental study. Aloe vera was examined for cholesterol-lowering capacity in hypercholesterolemic male Wistar rats (Rattus Norwegian) utilizing a pre-test-post-test control group. Medan State University's Faculty of Mathematics and Natural Sciences Animal House acclimated test animals for seven days. Citrullus Lanatus watermelon cream follows. After seven days of acclimatization, mice were randomly assigned to five treatment groups. To test phytochemicals' ability to moisturize dry mouse skin, skin moisture was measured. Quantifiable data (independent variables) was analyzed for treatment group effect significance using SPSS.

III. RESULTS AND DISCUSSION

Result

This study used 20 160-200-gram white Wistar rats. This study examined the effects of aloe vera extract (Aloe vera) on cholesterol in Wistar strain male white rats (Rattus norvegicus) with hypercholesterolemia.First, the mice are fed an exogenously administered high-cholesterol diet of quail egg yolks for 14 days as a preconditioning treatment to induce hypercholesterolemia.

Table 1. Characteristics of Test Animals

Component	Group K	Group P1	Group P2	Group P3
Types of Rats		*Rattus norvegicus*		
Gender		Male		
General condition		White fur, healthy and active		
AVG Initial B/W	251gr	250gr	252gr	251gr
AVG Final B/W	240gr	210gr	201gr	189gr

Mice ate high-fat, high-cholesterol diets daily. The feed is quail egg yolk. These foods raise cholesterol exogenously. Before aloe vera extract treatment, high-fat, high-cholesterol diets were administered for 14 days. Mice with hypercholesterolemia are diagnosed by body weight, cholesterol, and LDL levels.Mice's body weight was measured using an Ohauss scale with 0.1-gram precision. At the beginning of the 14th day following the high-fat diet introduction, significance was assessed. To determine if a high-fat diet causes obesity. According to Table 2, mice on a high-fat diet had a Lee index score of 0.3, indicating obesity. After receiving aloe vera extract at various doses, mice lost weight, as shown by Lee index values. At a Lee index of <0.3, mice treated with aloe vera extract were not considered obese. The table above shows the difference between obese mice given distilled water and those fed aloe vera extract at different doses. In the control group, the Lee index remained at 0.3. Treatment 1 with 1.5% aloe vera extract dropped to 0.29. In treatment groups 2 and 3, 3% and 4.5% of mice dropped to 0.28. Researchers found aloe vera extract altered obese mice's weight.

Table 2. Rat Body Weight

Parameter	Group	Mean	
		Day-14 (After high-fat diet)	Day 28 (After 14 days + aloe vera extract)
Body Weight (gr)	Control	251	240
	P1	250	210
	P2	252	201
	P3	251	189
Naso-anal length (cm)	Control	204	204
	P1	203	204
	P2	202	202
	P3	201	202
Lee index	Control	0.3	0.30
	P1	0.3	0.29
	P2	0.3	0.28
	P3	0.3	0.28

Second, serum was taken from all rats after 14 days on a high-fat, high-cholesterol diet to confirm elevated cholesterol levels.Table 3 shows that high-fat diets raised LDL in mice. LDL levels in the control group averaged 19.3mg/dl before a high-fat meal, rising to 29.1. In treatment group 1, LDL cholesterol jumped from 19.5mg/dl to 29.9mg/dl following 14 days of a high-fat diet. Treatment group 2 and the last group had beginning LDL levels of 19.7mg/dl and 29.5mg/dl, respectively. Researchers decided the test animals had hypercholesterolemia since LDL was > 27.2mg/dl.Treatment with aloe vera extract follows. Test animals acclimated and fed a high-fat diet were randomly placed into four groups. Each group had five mice. Each mouse's tail was identified with a waterproof marker. Mice in the control group received simply standard food. In the treatment group, mice received a high-fat diet and 1.5%, 3%, or 4.5% aloe vera extract. To determine the best extract concentration, this variation was done. After 14 days of treatment, researchers examined hypercholesterolemia mice's LDL levels again.After 14 days of aloe vera extract treatment (Table 4), researchers examined each animal's LDL levels again. LDL levels drop in each group, as shown in the table above. The control group's initial LDL level was 29.1mg/dl, but after eating a high-fat diet, it rose to

27.8mg/dl, indicating hypercholesterolemia. Aloe vera extract at 3.5% decreased from 29.9mg/dl to 26.3mg/dl in treatment group 2. Treatment group 2 decreased from 29.5mg/dl to 23.5mg/dl, while treatment group 3, with 4.5%, decreased the most, from 29.5mg/dl to 19.6mg/dl. The group given aloe vera extract no longer had high LDL levels or hypercholesterolemia, as LDL levels dropped to < 27.2mg/dl.

Table 3. Total Cholesterol Levels in Mice Induced by A High Cholesterol Diet

No	Group	Repetition	Day 0 Cholesterol Levels (mg/dl)	14th Day Cholesterol Levels (mg/dl)
1		1	51.6	59.2
2		2	52.1	56.5
3	Control	3	51.5	57.1
4		4	53.4	58.3
5		5	53.7	56.2
		Mean	**52.4**	**57.4**
6		1	50.4	56.7
7		2	53.9	59.8
8	Treatment I	3	51.9	59.6
9		4	51.5	58.3
10		5	52.2	58.1
		Mean	**51.9**	**58.5**
11		1	52.5	57.5
12		2	53.6	59.6
13	Treatment II	3	50.9	56.9
14		4	51.2	57.1
15		5	51.7	59.4
		Mean	**51.9**	**58.1**
16		1	53.5	59.1
17		2	52.4	58.9
18	Treatment III	3	50.7	56.4
19		4	51.6	57.3
20		5	52.7	58.2
		Mean	**52.1**	**57.9**

Table 4. LDL Levels of Mice Given Aloe Vera Extract

No	Group	Repetition	LDL levels after high fat diet (mg/dl)	LDL levels + aloe vera extract (mg/dl)
1	Control	1	29.2	28.2
2	(Aquades)	2	28.5	27.5
3		3	30.1	29.1
4		4	28.9	26.9
5		5	29.2	27.3
		Mean	**29.1**	**27.8**
6	Treatment I	1	30.7	27.2
7	(Concentration	2	29.8	25.9
8	1.5 %)	3	29.6	26.5
9		4	30.3	26.8
10		5	29.1	25.1
		Mean	**29.9**	**26.3**
11	Treatment I	1	29.5	24.2
12	(Concentration	2	28.6	23.6
13	3 %)	3	30.9	23.9
14		4	30.1	23.1
15		5	28.4	22.9
		Mean	**29.5**	**23.5**
16	Treatment I	1	29.1	19.2
17	(Concentration	2	30.6	20.4
18	4,5 %)	3	30.3	19.9
19		4	29.6	18.6
20		5	28.2	17.2
		Mean	**29.5**	**19.6**

A phytochemical test on aloe vera extract follows. In male Wistar rats (Rattus norvegicus) with hypercholesterolemia, phytochemical tests were performed to investigate if aloe vera extract components could lower cholesterol, LDL, and body weight. The tests measure tannin, saponin, flavonoids, alkaloids, and steroids/terpenoids.

Table 5. Phytochemical Test

Compound	Note
Flavonoid	+
Alkaloid	+
Saponin	+
Steroid	+
Tannin	+

Aloe vera extract included secondary metabolites, according to phytochemical studies. These included flavonoids, alkaloids, saponins, steroids, and tannins. These substances lower cholesterol, LDL, and body weight in hypercholesterolemia-afflicted Wistar white rats (Rattus norvegicus).

Table 6. LDL Normality Test

Group	N	Sig
Control	5	.200
P-1	5	.200
P-2	5	.200
P-3	5	.200

The Kolmogorov-Smirnov normalcy test yielded a significance level of 0.200 in all groups. A p-value> 0.05 indicates regularly distributed data. This implies that the data is regularly distributed. After confirming the data is normally distributed, the Levene test assesses if each variety of the study population group is homogeneous.

Table 7. Homogeneity Test Results

Levene Static	df1	df2	Sig
.956	3	16	.437

Table 7 shows Levene's homogeneity test findings. The probability in the significance column is 0.437. Since the significant probability value is greater than 0.05, the control group, treatment group-1, treatment group-2, and treatment group 3 are from populations with the same variance or are homogeneous.

Table 8. One-Way Anova Test Results

	Sum of Squares	df	Mean square	F	Sig
Between Groups	221.114	3	737.05	90.269	.000
Within Groups	13.064	16	.816		
Total	234.178	19			

The One-Way Anova test in Table 8 yields a significance value of 0.000 or <0.05. These statistics show a significant difference between the control and treatment groups.The LSD Post Hoc Test (Table 9) is used to compare two groups to see if there are statistically significant differences. Significant differences between the groups were found, as shown by a p-value for the Post Hoc LSD test analysis of 0.000 to 0.018 (less than 0.05).

Table 9. LSD Post Hoc Test

	Experimental Group (I)	Experimental Group (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LDL	Control (K)	Treatment P1	1.50000*	.57149	.018	.2885	2.7115
		Treatment P2	4.26000*	.57149	.000	3.0485	5.4715
		Treatment P3	8.74000*	.57149	.000	7.5285	9.9515
	(P1)	Control (K)	-1.50000*	.57149	.018	-2.7115	-.2885
		Treatment P2	2.76000*	.57149	.000	1.5485	3.9715
		Treatment P3	7.24000*	.57149	.000	6.0285	8.4515
	(P2)	Control (K)	-4.26000*	.57149	.000	-5.4715	-3.0485
		Treatment P1	-2.76000*	.57149	.000	-3.9715	-1.5485
		Treatment P3	4.48000*	.57149	.000	3.2685	5.6915
	(P3)	Control (K)	-8.74000*	.57149	.000	-9.9515	-7.5285

Experimental Group (I)	Experimental Group (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
	Treatment P1	-7.24000*	.57149	.000	-8.4515	-6.0285
	Treatment P2	-4.48000*	.57149	.000	-5.6915	-3.2685

Discussion

Trials of aloe vera extract (Aloe vera) to lower cholesterol in hypercholesterolemic male Wistar white rats (Rattus norvegicus). This study tested 20 Wistar white rats (Rattus norvegicus). The average mice weight before aloe vera extract treatment was 251 grams. The mice were weighed again on day 15 of the study, and each group had different average results. Control 240 grams, treatment 1 210 grams, treatment 2 201 grams, and last group 189 grams. These data show that all test groups lost body weight, but treatment group 3 lost the most, 19.6mg/dl.After receiving a high-fat diet of quail egg yolk for 14 days, the test animals were divided into four groups to receive different treatments: one control group received only distilled water, while the other three received aloe vera extract preparations at different concentrations. The first treatment group received 1.5% aloe vera extract, the second 3%, and the third 4.5%. After dividing white rats (Rattus norvegicus) of the Wistar strain with hypercholesterolemia into four groups, researchers investigated aloe vera extract (Aloe vera) for cholesterol reduction. Researchers also examined which concentration reduced cholesterol better in Wistar strain white rats (Rattus norvegicus) with hypercholesterolemia.A mismatch in energy intake and expenditure causes hypercholesterolemia. This condition raises blood cholesterol [5], [21], [27]. Cholesterol is essential for numerous cell processes, yet high blood levels can harm the body. Hypercholesterolemia is high LDL cholesterol [15], [27].Aloe vera helps treat hypercholesterolemia. Worldwide, aloe vera is the oldest and most commonly used medicinal plant. Aloe vera improves the immune system, raises HDL, lowers LDL, lowers blood sugar, and lowers blood sugar. High cholesterol is reduced with aloe vera [21], [22], [24].

Anti-cholesterol aloe vera contains glucomannan, anthraquinone, folic acid, lipase enzyme, lignin, vitamin B3, and vitamin C. Polysaccharides, flavonoids, carbohydrates, coumarins, tannins, chromones, alkaloids, anthraquinones, organic compounds, pyrones, phytosterols, anthrones, sterols, vitamins, proteins, and minerals are found in aloe vera [19], [20], [28]. Based on the benefits of aloe vera extract, researchers want to test its ability to decrease cholesterol in hypercholesterolemic Wistar white rats (Rattus norvegicus).This 14-day observation approach yielded data that needed to be processed and tested, requiring various data analyses. First, data is processed and normality tested. The Kolmogorov-Smirnov test in SPSS determined normality. All test groups have typically distributed data with a significance value of 0.000. Thus, the data is regularly distributed or represents the population.The Levene test determines if normally distributed data comes from a population with the same variance. Results reveal 0.437 significance. With a significance probability greater than 0.05, the control group treatment groups 1, 2, and 3 are homogeneous or from the same population. This customarily distributed and homogeneous data was assessed for efficacy and significance using One-Way ANOVA.One-way ANOVA test results demonstrate 0.000 or greater than 0.05 significance. Based on this data, a follow-up post-hoc LSD test is needed because the control group, treatment group 1, treatment group 2, and treatment group 3 differ significantly. A post-hoc LSD test was used to compare the group's average LDL cholesterol levels. This study's Post Hoc LSD test analysis indicated significance values of 0.000 and 0.018 or less than 0.05, indicating that all groups differed.To support their findings, researchers examined weight.

Using the Lee index, researchers compared the body weight of Wistar strain white rats (Rattus norvegicus) fed a high-fat diet to those provided distilled water and aloe vera extract at varied doses. In the control group, the Lee index remained at 0.3. Treatment 1 with 1.5% aloe vera extract dropped to 0.29. In treatment groups 2 and 3, 3% and 4.5% of mice dropped to 0.28. The researchers found that aloe vera extract altered obese mice's weight.Overall, mice with hypercholesterolemia had lower cholesterol, body weight, and LDL levels in each experimental group. Different average post-test values show lowering LDL levels. The control group given only distilled water had an intermediate LDL level of 27.8mg/dl, indicating hypercholesterolemia. Group 2 received 3.5% aloe vera extract, 26.3mg/dl. Treatment group 2 had 23.5mg/dl

LDL, and treatment group 3, with 4.5%, had 19.6mg/dl. The group given aloe vera extract no longer had high LDL levels or hypercholesterolemia, as LDL levels dropped to < 27.2mg/dl. Treatment group 3 received 4.5% aloe vera extract and had the best LDL decrease.The aloe vera extract group had lower LDL levels than the distilled water group, according to the experiment [19], [20], [22], [28]. Because aloe vera extract contains flavonoids, alkaloids, saponins, steroids, and tannins, this can happen. This bioactive molecule lowers LDL. Based on this study, aloe vera extract reduces hypercholesterolemia-afflicted Wistar white rats (Rattus norvegicus) cholesterol.

IV. CONCLUSION

Aloe vera extract (Aloe vera) reduces cholesterol, body weight, and LDL in hypercholesterolemia-afflicted male Wistar white rats (Rattus norvegicus). One-way ANOVA test results show a significant value of 0.000 or less than 0.05. These statistics show a substantial difference between the control and treatment groups. This study's Post Hoc LSD test analysis indicated significance values of 0.000 and 0.018 or less than 0.05, indicating that all groups differed.According to observations and data analysis, aloe vera extract reduces LDL significantly, and the group with a concentration of 4.5% reduced LDL levels more than the other groups in Wistar male white rats (Rattus norvegicus) with hypercholesterolemia.There needs to be more human studies done on aloe vera extract to determine its effect on HDL, LDL, and total cholesterol levels in human blood before it can be considered as an alternative medicine to help lower LDL and total cholesterol and raise HDL levels. More study is needed to conduct a more comprehensive lipid profile assessment and to conduct a more thorough evaluation of the substance content present in aloe vera extract to reinforce the research results.

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