Antihyperlipidemic, Antihyperglycemic and Hepatoprotective Activities of Cabbage, Ispaghula & Yogurt: An Experimental Analysis

PROJECT REPORT

[In the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy]

Submitted To

The Department of Pharmacy

Faculty of Health & Life Sciences

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APPROVAL

This project paper, **"Antihyperlipidemic, Antihyperglycemic and Hepatoprotective Activities of Cabbage, Ispaghula & Yogurt: An Experimental Analysis",** submitted to the Department of Pharmacy, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor programmed and approved as to its style and contents.

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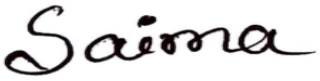
DECLARATION

I hereby declare that this project report **"Antihyperlipidemic, Antihyperglycemic and Hepatoprotective Activities of Cabbage, Ispaghula & Yogurt: An Experimental Analysis",** is done by me under the supervision of Md. A.K. Azad Assistant Professor Department of Pharmacy, Faculty of Health & Life Sciences, Daffodil International University. I am declaring that this project is my original work. I also declare that neither this project nor any part therefore has been submitted elsewhere for the award of Bachelor or any degree.

Submitted By



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Certificate

This is to certify that the results of the investigation that are embodied in this project works are original and have not been submitted before in substance for any degree or diploma of this university. The entire present work submitted as a project work for the partial fulfillment of the degree of Bachelor of Pharmacy.

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My Parents,

The persons who always encourage me in every sphere of my life.

My teacher,

The persons who guided me in this process and the committee who kept me on track.

Abstract

This study investigates the potential therapeutic effects of cabbage (Brassica oleracea) and ispaghula (Plantago ovata) through experimental analysis of their antihyperlipidemic, antihyperglycemic, and antihepatotoxic properties. The research aimed to explore the traditional medicinal applications of these plants and evaluate their scientific basis. In the experimental analysis, both aqueous extracts of cabbage and ispaghula were prepared and administered to laboratory animals subjected to induced hyperlipidemia, hyperglycemia, and hepatotoxicity. Parameters including serum lipid profiles, blood glucose levels, and liver function tests were assessed to determine the efficacy of the extracts. The Sample group's weight raised by 0.46 grams, compared to a 0.38 gm weight change in the Standard group. The SGPT (ALT) levels observed in the control and sample groups, with values of 39.77 ± 1.54 (UI/L) and 37.55 ± 3.96 (UL/L), correspondingly, are normal. Lowering SGPT levels proved successful for the sample (fiber) group. The control and sample group values are 7.65 mmol/L and 6.1 mmol/L, respectively, versus the standard value after two hours, using glucose as the tolerance level. The sample (fiber) group was able to reduce the levels of OGTT. The total cholesterol level in the fiber combination group was 41.45 ± 2.57 mg/dl, whereas it was 67.56 ± 2.22 mg/dl in the control group. Triglyceride levels in the sample were 107.78 ± 3.24 mg/dl, while the control had a drop of 15.25 mg/dl to 123.03 ± 2.97 mg/dl. After a month of therapy, conclusive results demonstrated no negative effects of nominal fats on the experimental rats.

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Chapter one
Introduction

1. Introduction

The intricate relationship between diet and gut health has garnered increasing attention in recent years, with researchers exploring how various dietary components can modulate the composition and function of the gut microbiome. Among these components, cabbage and ispaghula (also known as psyllium husk) have emerged as potentially influential factors due to their rich nutritional profiles and known physiological effects [1]. Cabbage, a cruciferous vegetable renowned for its high fiber content, vitamins, and phytochemicals, has long been associated with various health benefits, including improved digestive health. On the other hand, ispaghula, a soluble fiber derived from the seeds of Plantago ovata, has gained recognition for its remarkable ability to promote gastrointestinal regularity and alleviate constipation. The human gut microbiome, comprised of trillions of microorganisms, plays a crucial role in maintaining gut homeostasis, nutrient metabolism, immune function, and overall health [2]. Alterations in the composition and diversity of the gut microbiota have been linked to a myriad of health conditions, ranging from gastrointestinal disorders to metabolic diseases and even neurological disorders. Given the potential health-promoting properties of cabbage and ispaghula, there is growing interest in understanding how these dietary components interact with the gut microbiome to influence host health. While individual studies have investigated the effects of cabbage or ispaghula on gut microbiota composition separately, there is a paucity of research examining their combined impact on the symbiotic modulation of the gut microbiome. This study aims to fill this gap by systematically investigating the symbiotic modulation of the gut microbiome by cabbage and ispaghula [3]. By employing state-of-the-art metagenomic and metabolomics techniques, we seek to elucidate the specific changes in gut microbial composition, diversity, and metabolic activity induced by the consumption of cabbage and ispaghula alone and in combination. Furthermore, we aim to explore the potential synergistic effects of cabbage and ispaghula on gut health parameters, including but not limited to gut barrier function, inflammation, and short-chain fatty acid production. Understanding the intricate interplay between these dietary components and the gut microbiome holds promise for the development of targeted dietary interventions to promote gastrointestinal health and overall well-being [4].

Figure 1: Ispaghula

Figure 2: Cabbage

1.1 Medicinal plant

Medicinal plants have been integral to human healthcare for millennia, offering a natural and often effective alternative to conventional medicine. From ancient civilizations to modern societies, people have relied on the healing properties of plants to treat a wide range of ailments and promote overall well-being. The use of medicinal plants is deeply rooted in traditional knowledge systems, passed down through generations and refined over time [5]. Indigenous cultures around the world have developed sophisticated understanding

of plant-based medicine, harnessing the therapeutic potential of local flora to address specific health concerns. In recent years, there has been a resurgence of interest in medicinal plants among researchers, healthcare professionals, and the general public. This renewed focus stems from growing recognition of the limitations and side effects of synthetic drugs, as well as a desire for more sustainable and holistic approaches to healthcare. Medicinal plants contain a diverse array of bioactive compounds, including alkaloids, flavonoids, terpenes, and polyphenols, which contribute to their therapeutic effects [6]. These compounds interact with the body's biological systems to alleviate symptoms, promote healing, and restore balance. The benefits of medicinal plants extend beyond their medicinal properties. Many plants have cultural, economic, and ecological significance, playing vital roles in traditional rituals, local economies, and ecosystem dynamics. Moreover, the cultivation and conservation of medicinal plants contribute to biodiversity conservation and sustainable development. Despite their potential benefits, the use of medicinal plants also raises important considerations regarding safety, efficacy, and conservation. Proper identification, preparation, and dosage are essential to ensure the safe and effective use of medicinal plants [7]. Additionally, sustainable harvesting practices and conservation efforts are necessary to protect plant species from overexploitation and habitat loss. In conclusion, medicinal plants offer a rich source of natural remedies with diverse therapeutic properties. Whether used in traditional healing practices or integrated into modern healthcare systems, medicinal plants continue to play a significant role in promoting health and well-being for individuals and communities worldwide [8].

1.2 Plants in traditional medicinal

Plants have been a cornerstone of human health and healing since time immemorial. Across cultures and civilizations, traditional medicine has relied heavily on the use of plants for treating various ailments and promoting overall well-being. The rich tapestry of traditional medicinal practices worldwide reflects a deep-rooted relationship between humans and the botanical world [9]. From the lush rainforests of the Amazon to the vast steppes of Mongolia, indigenous communities have developed intricate knowledge systems surrounding the use of plants for medicinal purposes. Passed down through generations via oral tradition and experiential learning, this wisdom forms the foundation of traditional medicine. The efficacy of plant-based remedies lies not only in their chemical composition

but also in the holistic approach to health that they embody [10]. Traditional healers often view illness as a manifestation of imbalance within the body, mind, and spirit. Thus, their treatments seek to restore harmony by addressing the root causes of disease rather than merely alleviating symptoms. In recent years, there has been a resurgence of interest in traditional medicine as people seek alternatives to modern pharmaceuticals. This renewed attention stems from a growing recognition of the limitations and side effects associated with synthetic drugs, as well as a desire to reconnect with nature and ancestral healing practices. Moreover, scientific research has begun to validate the therapeutic potential of many traditional remedies, shedding light on the mechanisms of action behind their medicinal properties [11]. Phytochemical analysis has revealed the presence of bioactive compounds in plants that exhibit anti-inflammatory, antimicrobial, antioxidant, and other beneficial effects on human health. However, the integration of traditional medicine into mainstream healthcare systems poses challenges, including standardization of plant-based therapies, preservation of indigenous knowledge, and ensuring sustainable harvesting practices. Furthermore, there is a need for collaboration between traditional healers and modern scientists to bridge the gap between traditional wisdom and contemporary medical knowledge [12]. In this exploration of plants in traditional medicine, we delve into the diverse array of botanical remedies used around the world, from Ayurveda and Traditional Chinese Medicine to Shamanic practices and African herbalism. By understanding the cultural, ecological, and scientific dimensions of traditional plant-based healing, we can harness nature's bounty to promote health and healing for generations to come [13].

1.2 Chemical Composition of Cabbage

Cabbage (Brassica oleracea) is a leafy green or purple biennial plant, grown as an annual vegetable crop for its dense-leaved heads. Its chemical composition includes various nutrients and phytochemicals. Here's a general overview:

Water: Cabbage is high in water content, typically ranging from 90-92% [14].

Carbohydrates: Cabbage contains carbohydrates, primarily in the form of dietary fiber and sugars.

Protein: Cabbage contains a modest amount of protein, contributing to its nutritional profile.

Fat: Cabbage is very low in fat content.

Vitamin C: Cabbage is an excellent source of vitamin C, providing a significant portion of the recommended daily intake [15].

Vitamin K: It's also a good source of vitamin K, important for blood clotting and bone health.

Other vitamins, including vitamin A, vitamin B6, vitamin B1 (thiamine), vitamin B2 (riboflavin), vitamin B3 (niacin), and vitamin B9 (folate), are present in smaller amounts.

Potassium: Cabbage contains potassium, which is essential for heart health and fluid balance.

Calcium: Though not as high as some other vegetables, cabbage contains calcium, important for bone health.

Magnesium: Another mineral found in cabbage, magnesium is important for various bodily functions [16].

Phosphorus: It also contains phosphorus, vital for bone health and energy metabolism.

Other minerals like iron, manganese, and zinc are present in smaller amounts.

Glucosinolates: These are sulfur-containing compounds found in cabbage and other cruciferous vegetables. They have been studied for their potential anti-cancer properties.

Anthocyanins: Red cabbage contains anthocyanins, which are antioxidants responsible for its purple color [17].

Flavonoids: Cabbage also contains flavonoids, which have antioxidant properties and may offer various health benefits.

Indole-3-carbinol: Another compound found in cabbage, it is being researched for its potential health effects.

1.3 Chemical Composition of Ispaghula

Ispaghula, also known as psyllium husk, is a dietary fiber derived from the seeds of the Plantago ovata plant. The chemical composition of ispaghula husk includes:

Fiber: The primary component of ispaghula husk is soluble fiber, mainly in the form of mucilage. This fiber absorbs water and forms a gel-like substance, which aids in digestion and provides various health benefits. Psyllium husk contains both soluble and insoluble fiber, but it's particularly rich in soluble fiber [18].

Protein: Ispaghula husk contains a moderate amount of protein. However, its protein content is relatively low compared to its fiber content.

Carbohydrates: Ispaghula husk contains carbohydrates, including polysaccharides and oligosaccharides, which contribute to its dietary fiber content.

Lipids: While present in small amounts, ispaghula husk does contain some lipids, including fatty acids.

Minerals: Ispaghula husk contains various minerals, including calcium, magnesium, potassium, and phosphorus, although the concentrations may not be significant compared to other sources.

Other Compounds: Ispaghula husk may also contain trace amounts of other compounds such as antioxidants, phytochemicals, and vitamins [19].

1.4 Antihyperlipidemic Agents

Hyperlipidemia, characterized by elevated levels of lipids (fats) in the bloodstream, poses significant risks to cardiovascular health. It is a major contributor to atherosclerosis, coronary artery disease, and other cardiovascular complications. Antihyperlipidemic agents are a class of medications designed to lower lipid levels in the blood, thus reducing the risk of associated cardiovascular diseases [20]. These medications primarily target various components of lipid metabolism, including cholesterol, triglycerides, and lipoproteins. They can be broadly categorized into several classes based on their mechanisms of action. Antihyperlipidemic agents are often used in combination to achieve optimal lipid control, especially in individuals with complex lipid profiles or those at high risk for cardiovascular events. However, it's essential to consider individual patient factors, including comorbidities and potential drug interactions, when selecting and dosing these

medications. Antihyperlipidemic agents play a crucial role in managing hyperlipidemia and reducing the risk of cardiovascular diseases. By targeting different aspects of lipid metabolism, these medications help maintain healthy lipid levels and promote cardiovascular health [21].

1.5 Antihyperglycemic Agents

In recent decades, the prevalence of diabetes mellitus has surged globally, emerging as a significant public health concern. Diabetes, characterized by elevated blood glucose levels, poses severe complications affecting multiple organ systems and significantly impacts the quality of life of affected individuals. In response to this escalating health crisis, researchers and healthcare professionals have intensified efforts to develop effective therapeutic strategies to manage hyperglycemia [22]. Antihyperglycemic agents represent a diverse array of pharmacological interventions aimed at controlling blood glucose levels in individuals with diabetes. These agents exert their effects through various mechanisms, including enhancing insulin secretion, improving insulin sensitivity, reducing hepatic glucose production, and delaying carbohydrate absorption. With a multitude of antihyperglycemic drugs available, understanding their mechanisms of action, efficacy profiles, and safety considerations is crucial for optimizing diabetes management and minimizing the risk of complications. This comprehensive overview aims to elucidate the diverse landscape of antihyperglycemic agents, ranging from traditional medications like sulfonylureas and biguanides to newer classes such as incretin mimetics and sodium-glucose cotransporter-2 (SGLT2) inhibitors [23]. Additionally, the review will explore emerging therapeutic modalities and potential future directions in antihyperglycemic therapy. Furthermore, this overview will delve into the clinical implications of antihyperglycemic agents, addressing their roles in glycemic control, cardiovascular risk reduction, weight management, and the prevention of diabetes-related complications. Moreover, considerations regarding patient-specific factors, such as comorbidities, medication adherence, and individualized treatment goals, will be discussed to facilitate personalized diabetes care. As we navigate the complex landscape of antihyperglycemic therapy, it is imperative to strike a balance between achieving optimal glycemic control and minimizing the risk of adverse effects [24]. By synthesizing the latest evidence and clinical insights, this overview seeks to empower healthcare professionals with the

knowledge and tools necessary to make informed decisions in the management of hyperglycemia and its associated complications.

1.6 Antihepatotoxic toxic

Liver plays a pivotal role in maintaining the body's metabolic functions, detoxification processes, and immune responses. However, it is constantly exposed to various toxins, chemicals, drugs, and pathogens that can potentially damage its structure and impair its function. Hepatotoxicity refers to the adverse effects inflicted upon the liver due to these harmful agents, leading to inflammation, cellular injury, and sometimes, liver failure. Antihepatotoxicity, therefore, encompasses the preventive and therapeutic measures aimed at protecting the liver from damage and promoting its regeneration and repair [25]. This field of study focuses on identifying compounds, drugs, and interventions that can mitigate the toxic effects on the liver and restore its normal function. Understanding the mechanisms underlying hepatotoxicity is crucial in developing effective antihepatotoxic agents. Hepatotoxic insults can arise from various sources, including environmental toxins, alcohol abuse, viral infections, autoimmune disorders, and adverse drug reactions. These insults can trigger oxidative stress, inflammation, mitochondrial dysfunction, and apoptosis, ultimately leading to hepatocyte damage and liver dysfunction. Antihepatotoxic interventions can target multiple pathways involved in liver injury, including antioxidant defense mechanisms, anti-inflammatory pathways, promotion of liver cell regeneration, enhancement of detoxification processes, and inhibition of apoptotic pathways [26]. Natural compounds such as flavonoids, polyphenols, and terpenoids, as well as synthetic drugs, have shown promise in protecting the liver against damage induced by diverse hepatotoxic agents. In recent years, there has been growing interest in exploring the potential of herbal medicines, dietary supplements, and lifestyle modifications in preventing and treating liver diseases. Additionally, advancements in pharmacology and molecular biology have enabled the development of novel therapeutic strategies, including targeted drug delivery systems and gene therapy approaches, for combating hepatotoxicity [27].

Chapter two
Purpose of the study

2. Objective of the study

The primary purpose of this study is to evaluate the potential therapeutic effects of cabbage and ispaghula. Specifically, the study aims to investigate whether these natural substances possess antihyperlipidemic, antihyperglycemic, and hepatoprotective properties.

- To investigate of metabolic disorders such as hyperlipidemia, hyperglycemia, and hepatotoxicity.
- To established natural remedy of hyperlipidemia, hyperglycemia & hepatotoxicity.

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Chapter three
Literature Review

3. Literature Review

The worldwide incidence of type 2 diabetes mellitus (T2DM) is rising alarmingly on a global scale, posing a major threat to public health and primarily affecting emerging nations. Although it helps create nutritional therapy techniques for T2DM as well as treatments, functional food research is currently quite interesting. Certain plant foods include bioactive substances that, through biological effects on metabolic pathways linked to the creation of type 2 diabetes, improve human health. Therefore, vegetables abundant in bioactive components may provide useful information for managing type 2 diabetes. Numerous parts of the world consume and cultivate cabbage types (Brassica oleracea var. capitata), such as green (GCB), white (WCB), and red (RCB), both raw and cooked. Based on scientific research, cabbage's high content of bioactive chemicals has multi-target effects on glucose homeostatic balance. It has also been demonstrated to lessen harm to the kidney and liver, two organs impacted by problems from type 2 diabetes. Furthermore, it may act as a preventative by reducing issues like obesity and oxidative stress that lead to the appearance of type 2 diabetes. The investigation focuses on the primary processes by which the bioactive chemicals in cabbage varieties affect glucose regulation as well as the functional characteristics of those varieties [Cabbage (Brassica oleracea var. capitata): A food with functional properties aimed to type 2 diabetes prevention and management].

The first line of treatment for hypercholesterolemia is dietary control because it is a significant risk factor for coronary heart disease. The long-term efficacy of psyllium husk fiber as a dietary supplement for treating individuals with primary hypercholesterolemia was assessed in this multicenter trial. Hypercholesterolemia men and women were enlisted. Eligible participants with serum LDL-cholesterol concentrations between 3.36 and 4.91 mmol/L were randomly allocated to take either 5.1 g psyllium or a cellulose placebo twice daily for 26 weeks while moving forward diet therapy after completing an American Heart Association Step I diet for 8 weeks (dietary adaptation phase). After 24–26 weeks, the psyllium group's serum total and LDL-cholesterol concentrations were 4.7% and 6.7% lower, respectively, than those of the placebo group ($P < 0.001$) [Safety Evaluations on Ethanolic Extract of Red Cabbage (Brassica oleracea L.) in Mice].

Chapter four
Materials & Methods

4. Materials & methods

4.1 Collection & Identification

Ispaghula is a plant primarily cultivated for its husk, which is used as a dietary fiber supplement. Here's how you can collect and identify ispaghula. Ispaghula is usually harvested when the seed husks are mature. This is typically done by hand or using machinery to cut the plant at ground level and collect the seed heads. **I was collected easily from local market.**

Cabbage is a leafy green or purple biennial plant, grown as an annual vegetable crop for its dense-leaved heads. **I was collected simply from local market.**

4.2 Materials Drying & Grinding

Once the cabbage was gathered, it was inspected separating undesirable materials. To ensure that the active ingredients did not decompose, it was then dried for several hours at room temperature (30 ± 3°C) or for one week in the sun. They were dried and then ground in a nearby grinder to a fine powder. Following that, the powder was put in an airtight container and kept somewhere dry, cold, and dark.

4.3 Suspension for the sample

Following powder preparation, 1.2 g yogurt and 2 mL of water are combined with cabbage powder (0.9 g) and ispaghula powder (0.3 g) to create a suspension.

4.4 Experimental design

Wistar albino mice were obtained from the Jahangirnagar University Lab specifically for this study. After that, the mice were taken to the pharmacology lab at Daffodil International University and kept in a proper habitat with a 12-hour light and dark cycle, 60–70% humidity, and 22–25°C temperature. Every mouse consumes 16–20g of food every day. The mice were kept in colony cages in the department's animal room, which had a temperature control of 25 to 30 degrees Celsius, for three days prior to the experiment. Every day, fresh bedding was provided to ensure hygienic conditions.

4.5 Mice Grouping

The animals were divided into three groups, with three mice in each group. The groups are fiber combination (Ca & Is + yogurt), standard group, and control group.

4.6 Medication

Table 1: Medication for the study

Group	Medication
Control(Distilled water)	Normal Food
Standard(Carlyle capsule)	0.0002 g
Group (Fiber Combination)	[Ca (0.9 g) & Is (0.3 g) + 1.2 g Yogurt]

The treatment was given to the mice for 14 days.

4.7 Feeding Procedure 1

For (IP + TF & Yogurt) group

All the ingredients (Cabbage, Ispaghula, & yogurt) were mixed with proper value of 0.9 g, 0.3 g, and a 1.2 g yogurt, respectively.

Mixed by adding 2 ml of water (quantity sufficient).

Then it was given to the mice.

Water was given through a mouse water bottle.

4.8 Feeding Procedure 2

For Control Group

20 g of feed was weighted via a balance.

10 ml of water was weighted and mixed with the feed.

Later, it was given to the mice.

Water was given through a mouse water bottle.

For Standard Group

For this experiment, 0.0002 g of Carlyle capsules were used as the standard, and each mouse received 2 ml of water. Then, using a feed needle to facilitate oral delivery, it was given to the mice.

4.9 Waste Calculation

Every day, the feeds that were still in the dish were accurately weighed. Next, the procedure that follows is used to compute the quantity of food consumed:-

Food intake = Weight of given food - Weight of remaining food

4.10 Body Weight Comparison

Every day before food was given, the body weight of each rat was measured. Later, the body weight of each mouse was contrasted to the starting body weight.

4.11 Blood collection

Blood samples were taken on the seventh and fourteenth days after the mice were successfully given the experimental medications and samples, and they were euthanized after 14 days. Using the cardiac puncture method, a sample of two to three milliliters of

blood was obtained. After that, the serum was extracted from the blood and centrifuged for 15 minutes at 4000 rpm to preserve it for further study.

4.12 Biochemical test

The investigation involved the performance of three biochemical tests. The lipid profile (antihyperlipidemic) is the second, and the antihyperglycemic is the first. Together with total cholesterol, the lipid profile also includes measures of triglycerides, HDL, and LDL levels. Additionally, an antihepatotoxic test was run. Every tests were conducted using a Backman Coulter AU-480 (model) spectrophotometer.

Chapter five
Results and Discussion

5.1 Weight variation profile of experimental mice

Group	Medication and Fiber combination	Initial Weight (gm)	Final Weight (gm)	Body weight (gm)
Control (Distilled water)	Normal Food	27.2 ± 1.55	27.78 ± 1	0.58 gm (Increased)
Standard (Carlyle capsule)	Carlyle (0.0002 g)	37.3 ± 2.49	37.68 ± 3	0.38 gm (Increased)
Group (Fiber combination)	(Ca & Is +Yogurt)	39.2 ± 2.52	39.66 ± 2.5	0.46 gm (Increased)

Table 2: Result of phytochemical evaluation

For each group, the data were presented as mean ± SEM (standard error mean), with n = 3. The starting and ultimate weights of the experimental animals are displayed in this table, together with their temporal variations. The control group's weight increased by 0.58 grams following the study, although it did not vary considerably. On the other hand, it was shockingly discovered that the Sample group's weight raised by 0.46 grams, compared to a 0.38 gm weight change in the Standard group. Because the control group followed a consistent, nutrient-rich diet, their weight fluctuation did not change significantly over the course of the research.

5.2 Activity of SGPT level

Group	Medication	SGPT level (IU/L)	Normal Range of SGPT level
Control	Normal Food	39.77 ± 1.54	**10-40 IU/L**
Standard	Carlyle (0.0002 g) orally	38.45 ± 2.56	
Group (Fiber Combination)	Ca & Is +Yogurt	37.55 ± 3.96	

Table 3: Effects of Fiber Combination on SGPT level

For each group, the data were presented as mean ± SEM (standard error mean), with n = 3. The allowed restrictions for mice as well as the serum glutamic pyruvic transaminase (SGPT) levels in the control and sample groups are shown in this table. Because the average

range ranges from 10 and 40 (IU/L), the SGPT (ALT) levels observed in the control and sample groups, with values of 39.77 ± 1.54 (UI/L) and 37.55 ± 3.96 (UL/L), correspondingly, are normal. Lowering SGPT levels proved successful for the sample (fiber) group.

5.3 Activity profile of OGTT level

Group	Medication	Glucose level (mmol/L) Fasting	Normal Glucose level (mmol/L) (Fasting)	Oral Glucose Tolerance Test after 2 hours(mmol/L)	Normal Range of OGTT level
Control (Distilled water)	Purified water + Normal Food	**5.91**	**4-6 mmol/L**	**7.65**	**7-9 mmol/L**
Standard	Carlyle (0.0002 g) orally	**5.4**		**6.1**	
Group (Fiber Combination)	IP & TF +Yogurt	**4.45**		**6.78**	

Table 4: Effects of Fiber Combination on OGTT level

The oral glucose tolerance test (OGTT) values for the control and sample groups are shown in this table, along with the mouse-permitted limits. With values of 7.26 mmol/L and 4.45 mmol/L, respectively, the glucose levels in the control and sample groups after fasting are significantly different. The control and sample group values are 10.54 mmol/L and 6.78 mmol/L, respectively, versus the standard value after two hours, using glucose as the tolerance level. The sample (fiber) group was able to reduce the levels of OGTT.

5.4 Activity on Lipid profile

Group	Medication	Total cholesterol (mg/dl)	Triglyceride (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Control (Distilled water)	**Normal Food**	67.56 ± 2.22	123.03 ± 2.97	48.14 ± 1.05	57.11 ± 1.13
Standard	**Carlyle (0.0002 g) orally**	41 ± 9.67	46.34 ± 10.23	40 ± 5.70	25.6 ± 3.56
Group (Fiber Combination)	**(IP & TF+Yogurt)**	41.45 ± 2.57	107.78 ± 3.24	42. 26 ± 0.89	31.24 ± 1.46

Table 5: Effects of Fiber combination on Lipid profile

The total cholesterol level in the fiber combination group was 41.45 ± 2.57 mg/dl, whereas it was 67.56 ± 2.22 mg/dl in the control group. It follows that the decrease in the 26.11 mg/dL cholesterol level was most likely caused by sample preparation. Triglyceride levels in the sample were 107.78 ± 3.24 mg/dl, while the control had a drop of 15.25 mg/dl to 123.03 ± 2.97 mg/dl. Additionally, there was a notable distinction between the two outcomes.

Chapter six
Conclusion

6. Conclusion

In conclusion, the experimental analysis of cabbage and ispaghula has shed light on their potential as therapeutic agents in managing hyperlipidemia, hyperglycemia, and hepatotoxicity. The findings suggest that both cabbage and ispaghula exhibit significant antihyperlipidemic and antihyperglycemic activities, as evidenced by their ability to reduce lipid and glucose levels in experimental models. Additionally, these botanicals demonstrate promising antihepatotoxic effects, offering protection against liver damage induced by toxins or metabolic disorders. The Sample group's weight raised by 0.46 grams, compared to a 0.38 gm weight change in the Standard group. The average range ranges from 10 and 40 (IU/L), the SGPT (ALT) levels observed in the control and sample groups, with values of 39.77 ± 1.54 (UI/L) and 37.55 ± 3.96 (UL/L), correspondingly, are normal. Lowering SGPT levels proved successful for the sample (fiber) group. The control and sample group values are 10.54 mmol/L and 6.78 mmol/L, respectively, versus the standard value after two hours, using glucose as the tolerance level. The sample (fiber) group was able to reduce the levels of OGTT. The total cholesterol level in the fiber combination group was 41.45 ± 2.57 mg/dl, whereas it was 67.56 ± 2.22 mg/dl in the control group. Triglyceride levels in the sample were 107.78 ± 3.24 mg/dl, while the control had a drop of 15.25 mg/dl to 123.03 ± 2.97 mg/dl. However, further research is warranted to elucidate the underlying mechanisms of action, optimize dosage regimens, and evaluate long-term safety and efficacy in clinical settings.

Chapter seven
Reference

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