



(REVIEW ARTICLE)



Effects of sargassum on insulin sensitivity

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Abstract

Type 2 diabetes mellitus is a condition where the body becomes resistant to insulin and keeps having high blood sugar levels over a long period of time. Oxidative stress can cause problems with how the body handles glucose and makes insulin work better, which shows that there is a need for other natural treatment options. One possible natural source is the brown algae called Sargassum, which has bioactive compounds that help with diabetes and provide antioxidant benefits. This study looked into how Sargassum affects insulin sensitivity and blood glucose levels by examining articles from national and international journals found on Google Scholar and PubMed, which were published between 2017-2026. The studies that were reviewed found that Sargassum has active compounds like polyphenols, flavonoids, alginate, and fucoxanthin. These compounds might help the body use insulin better by slowing down the enzymes that break down carbohydrates, which can help control how quickly sugar is absorbed into the blood. They also may lower the stress on the body caused by insulin resistance. Several experiments also showed big drops in blood sugar levels and effects that are similar to regular diabetes medicines in lowering high blood sugar. The results show that Sargassum could be a good natural option for helping manage diabetes. It might help the body use insulin better and keep blood sugar levels more stable, which means it could be a helpful addition to treatment for people with type 2 diabetes.

Keywords: Sargassum; Insulin Sensitivity; Type 2 Diabetes Mellitus; Antidiabetic; Polyphenols

1. Introduction

Type 2 diabetes mellitus is a disease that occurs because the body does not respond well to insulin and the process of breaking down sugar in the blood does not run normally, resulting in persistently high blood sugar levels. Insulin resistance occurs when the body cannot respond properly to insulin, which is associated with oxidative stress and inflammation. Therefore, the use of natural ingredients that can improve the ability to respond to insulin is one of the therapeutic options that is being widely researched. One natural ingredient that has potential is the brown seaweed Sargassum which contains various bioactive compounds such as polyphenols, flavonoids, alginate, and fucoxanthin. The polyphenol compounds in Sargassum can inhibit the action of the enzymes α -amylase and α -glucosidase, so that the process of glucose absorption into the body becomes slower and blood glucose levels can be better regulated. In addition, flavonoids and phenolic compounds in Sargassum have the ability to fight free radicals, thereby reducing oxidative stress, protecting pancreatic cells that play a role in insulin production, and helping to increase the efficiency of insulin work in the body [1].

In addition, Sargassum also contains fucoxanthin, a carotenoid pigment unique to brown algae that has the ability to fight free radicals. Fucoxanthin is believed to have potential for development in the pharmaceutical and health sectors because it can protect cells from damage caused by free radicals. This antioxidant activity is crucial for preventing persistent inflammation and helping improve insulin sensitivity in the body of diabetics [2].

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Recent research also shows that fermenting Sargassum using SCOBY can improve its biologically active substance content and blood sugar-lowering ability. The combination of Sargassum sp. and Ulva sp. extracts has a high phenolic content of 69.63 ppm and also has strong α -amylase enzyme inhibitor activity with an IC50 value of 4.04 ± 0.09 ppm. This activity indicates that the polyphenol compounds in Sargassum can inhibit the process of carbohydrate breakdown and slow the absorption of glucose into the blood, thereby helping to improve the body's ability to respond to insulin and maintain stable blood glucose levels. In addition, other research shows that Sargassum extract can reduce blood sugar levels in mice given alloxan by 54.20% to 58.12%, which is better than glibenclamide which was only able to reduce it by 42.86%. These results further demonstrate the possibility that Sargassum can be a natural ingredient that helps prevent or support the treatment of type 2 diabetes mellitus by improving the body's response to insulin and reducing increases in blood sugar levels [3].

Based on the above explanation, this Literature Review was conducted to examine and analyze the matters that have been discussed. Analyze various research results regarding the impact of Sargassum on the body's ability to respond to insulin, especially through the mechanism of antihyperglycemic activity, inhibition of the enzymes α -amylase and α -glucosidase and antioxidant activity that helps improve insulin function and improve insulin action. Control of blood glucose levels.

2. Material and methods

The method used in writing this article is a literature review study. Literature review is a research activity that uses secondary data from various related studies or literature sources that are relevant to the research problem. These sources are typically found in books, articles, or relevant journals [4]. The writing starts by looking for articles that are related to the research topic that will be carried out. The criteria for the academic articles used as data include articles from national or international journals published within the last 10 years, which is from 2017 to 2026. The search for articles was conducted using the databases available on Google Scholar. At the beginning of the article search, 211 articles were found using the search keywords "effect of sargassum on insulin effectiveness." The next step is to validate the scientific articles by removing those that do not match the topic idea based on their titles. The scientific articles obtained through this process amount to 15 articles, which include both research articles and review articles. Next, a quality review of relevant scientific articles related to the research topic was carried out by reading through the entire content of the articles. The purpose was to check how well the articles matched the research topic, and a total of 15 relevant articles were found.

3. Results

Literature Review Results Based on the established search strategy and literature selection process, relevant articles were identified that met the inclusion criteria for further analysis. These articles included studies on the variables studied and their influence on the final outcomes that were the focus of this review. A summary of all articles used in this literature review is presented in the data analysis matrix as follows

Table 1 Data analysis matrix on journals used in literature review

No.	Author Name	Journal Name (Volume, Issue, Page)	Article Title	Method	Research purposes	Research result
1	Aunurrahman et al., (2024) DOI: http://doi.org/10.29303/jbt.v24i4.7756(5)	Journal Biology Tropical, 24 (4): 887-894	Potential of Ulva lactuca and Sargassum duplicatum as Antihyperglycemic Agents in Type 2 Diabetes Mellitus	Methods used by researchers in study This is method writing studies literature that uses source library through Google Scholar and several credible websites like Pubmed with year 10- year search final For articles and journals in form both Indonesian and Language English	For study potential of Ulva lactuca and Sargassum duplicatum as agent antihyperglycemic through studies literature	Research result show that Sargassum duplicatum contain compound bioactive such as phlorotannin which is capable of hinder α -glucosidase and α - amylase enzymes as well as increase absorption glucose in the tissues muscles. Mechanism the contribute to decline insulin resistance and increased insulin sensitivit , so Sargassum has the potential as agent antihyperglycemic experience with effect minimal side

2	<p>Abdul M. Ukratalo et al., (2024) DOI: https://doi.org/10.59680/anestesi.v2i3.1102(6)</p>	<p>Journal Anesthesia : Journal Hygiene</p>	<p>Weight Changes in Mice (Mus musculus) with Diabetes Mellitus Model Type 1 Under Treatment Brown Algae Extract Sargassum sp</p>	<p>Use method experiment with share mice to in a number of group treatment and control , then observe change weight before and after diabetes induction as well as after giving extract</p>	<p>For know influence giving Sargassum sp extract to change body weight of mice with diabetes mellitus model type 1</p>	<p>Research result show that giving *Sargassum sp * extract is capable increase body weight of diabetic mice significant after experience decline consequence streptozotocin induction . Increased This allegedly related with content compound bioactive such as flavonoids, phenols , saponins, and tannins which have activity antioxidant and antidiabetic , as well as play a role in repair metabolism glucose and increase function pancreatic β cells . Increased body weight in the diabetes model reflects repair utilization glucose by cells which indicates existence improvement sensitivity or insulin activity in body</p>
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3	<p>Christy Sahetapy et al., (2019) DOI https://ojs3.unpatti.ac.id/index.php/pameri/index (7)</p>	<p>Journal pameri – pattimura medical review, 1 (1)</p>	<p>Influence Stres I On Blood Sugar Levels in Mice with Treatment Extract Ethanol Brown Algae (Sargassum sp.)</p>	<p>Study This is study experiment pure with design pre-test and post test control group design, namely with method compare results observation before and after in the group control and treatment</p>	<p>For know influence giving extract brown algae ethanol to blood sugar levels mice that experienced stress I</p>	<p>Study This show that giving Sargassum extract does not give influence significant to decline blood sugar levels in conditions stress acute ($p>0.05$). Although However , Sargassum remains known contain compound bioactive such as flavonoids, alkaloids, phenolics , and fucoxanthin which play a role in regulations metabolism glucose and insulin resistance . These results show that the effectiveness of Sargassum can influenced by conditions physiological certain , so that required study more carry on For study in a way specific its influence to insulin sensitivity</p>
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4	Ulvi Ditasari, Agung Giri Samudra, Reza Pertiwi(8)	Medical Science: Journal Scientific Pharmacy (2022, Vol. 7 No. 4, October, 789-796)	Effectiveness Antihyperglycemia Extract Ethanol Ulva sp. and Sargassum sp. in mice induced by Sucrose	Study This use method experimental with in vivo approach in animals try in the form of mice (Mus musculus). The research design used is post-test control group design , where 20 animals mice male shared become four group , namely control positive (metformin), control negative (CMC Na), as well as two groups treatment given extracts of Sargassum sp. and Ulva sp. each with the same dose . Mice fasting before treatment , then injected surosa For increase level glucose blood . Measurement level glucose done in a way periodically at several intervals , namely minute 15th, 30th, 45th, 60th, 90th, 120th, and 150th after treatment . Data obtained analyzed using the one-way ANOVA statistical test continued direction with LSD test for know difference significant between group .	For compare effectiveness Sargassum sp. and Ulva sp. extracts as agent antihyperglycemic in lower level glucose blood as well as determine which extract is more effective on test animals	Research result show that Sargassum sp. and Ulva sp. extracts have effect significant antihyperglycemia compared to with control negative (p<0.05). Percentage decline level glucose blood in the Sargassum sp. group was 22.37%, while in the Ulva sp. group it was 16.28%. In addition , the Area Under Curve (AUC) value showed that Sargassum sp. group has greater value low compared to Ulva sp., which means ability in lower level glucose blood more good . Although Thus , the effectiveness second extract the Still be under control positive (metformin). Activity antihyperglycemic This allegedly originate from content compound bioactive like phenol and flavonoids that play a role as antioxidant , capable hinder absorption glucose in the intestines, increasing insulin secretion , as well as protect cell pancreas from damage consequence stress oxidative .
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5	Muhammad Firdaus, Rahmi Nurdiani, Bachtiar Rivai , Windy Hapsari Hemassonida, Aqilatul Badzliyah, Nur Khasanah Sugiat(9)	Journal of Applied Pharmaceutical Science (2022, Vol. 12(03), 132-139)	The glucose uptake of type 2 diabetic rats by Sargassum oligocystum extract: In silico and in vivo studies	Study This use design experimental with approach combination in silico and in vivo . On studies in silico , conducted molecular docking analysis For see interaction between compound bioactive in extract Sargassum oligocystum with PTP1B enzyme . Meanwhile that , research in vivo done use mouse male Induced Rattus norvegicus become type 2 diabetes through administration of a high- fat diet and injection of streptozotocin (STZ). Experimental animals shared become six group , namely normal group , without diabetes treatment , diabetes with drug comparator (pioglitazone), as well as three group diabetes given extract with frequency different . Treatment done for 45 days , with the parameters measured covering level glucose blood , insulin, HOMA-IR, glucose AUC , and PI3K and Akt expression using ELISA method . Data analysis was carried out in a way statistics with	For know ability extract grass sea Sargassum oligocystum in increase absorption glucose identify compound bioactive content in extract the	Research result show that extract Sargassum oligocystum capable lower level glucose blood , insulin, HOMA-IR values , and glucose AUC in diabetic rats were compared group without treatment , although the effect Still more low compared to pioglitazone. In addition , the extract this also increases expression of PI3K and Akt proteins which play a role important in track insulin signaling and absorption glucose . From the results analysis in silico , found that one of compound active The main ingredient , namely rhamnetin, has affinity strongest binding to PTP1B enzyme compared other compounds as well drug comparator , so that potential as a PTP1B inhibitor. Identification metabolit show existence various compound bioactive such as flavonoids, polyphenols , amino acids , and derivatives others who contributed to effect antidiabetic
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				Duncan's test at the level 5% significance		
6	Glodeliva Sesa Sakka, Muhammad Syahrir, Hilda Yasni, Jeny Noer Kholifah, Zahrah Fakhirah Lukman(10)	ILLEA: Journal of Health Sciences, Public Health, And Medicine, (2025, Vol. 1, No. 1., 1-8)	A Review: Compound Fucoxanthin from Various Algae and Its Application in the Field Health	Study This use method review library or studies library , which means collect and analyze results study previous . Source of data obtained from various scientific databases such as Google Scholar, ScienceDirect, MDPI, and PubMed, with range publication from 2014 to 2024. Analysis process done in a way descriptive with collect , compare , and explain various findings related content chemistry fucoxanthin and its benefits for health .	For study and describe more Far about exploration compound fucoxanthin of algae that cover technique extraction and isolation as well as the application in field health	Research result show that fucoxanthin is compound carotenoids main in brown algae which have various activity biology important . From various the literature described , found that fucoxanthin own activity as antioxidants strong with ability neutralize radical free , and own effect anti-inflammatory , antimicrobial , anticancer , and neuroprotective . In addition , fucoxanthin also plays a role in arrangement lipid metabolism so that potential as anti- obesity and antidiabetic agents . In aspect technical , method common extractions used is maceration with solvent like ethanol or methanol , whereas purification done use chromatography column silica gel.

7	Agung Giri Samudra, Nurfitriin Ramadhani, Cyntia Dwi Utami, Nori Wirahmi , Fathnur Sani(11)	Journal Manuntung Scientific , 2021, Vol. 7 No. 2, Pg. 248-253	Effectiveness Test Antihyperglycemia Brown Sea Algae (Sargassum hystrix) Infusion in Male Mice Using the Tolerance Method Glucose	Study experiment use method tolerance glucose . Sample of 20 rats mice male shared into 4 groups : control positive (glibenclamide), control negative (CMC Na), and treatment Sargassum hystrix infusion at 2.5% and 5% concentrations . Measurement level glucose blood carried out at the 30th, 60th, 90th, and 120th minutes after giving Glucose . Data analysis used One Way ANOVA and LSD follow-up tests .	Prove effect antihyperglycemic infusion of Sargassum hystrix in lower level glucose blood in mice male .	Sargassum hystrix infusion shows effect antihyperglycemic significant (p<0.05). The 5% concentration is most effective dose in lower level glucose blood and have approaching effect control positive (glibenclamide).
8	Setyaning Pawestri , Renita Wijayanti, Dedy Kurnianto(12)	JIPHP (Journal Food and Agricultural Science), Vol. 6 No. 2, December 2021, pp . 13-3	Literature Review: Potential Contents in Sargassum sp. as Alternative Handling Type 2 Diabetes Mellitus	Study This use method studies literature (literature review) with collect and analyze various results study previously related content polyphenols in Sargassum sp. and their role in diabetes mellitus control . The data used originate from journal scientific , good national and international , relevant with topic study .	For study potential content compound polyphenols in Sargassum sp. as alternative in management of type 2 diabetes mellitus , as well as explain mechanism Work polyphenols in control level glucose blood .	Study results show that Sargassum sp. has content high polyphenols , which play a role as antioxidants as well as own activity antidiabetic . Polyphenols Work through a number of mechanism , namely with hinder α - amylase and α -glucosidase enzymes so that slow down solution carbohydrates , inhibit absorption glucose in the intestines, increasing function pancreatic β cells in insulin production , as well as increase taking glucose by tissues body .

9	Windy Rizky Saputri Antameng, Diani Mega Sari, and Shinta Sari Dewi.(13)	FARMASAINS: Journal of Pharmacy and Health Sciences , Vol. 10 (2), 2025	Antidiabetic Effectiveness Of Seaweed Extract (Sargassum Polycystum C. Agardh) As Adjuvant Therapy Metformin In Alloxan Induced Mice.	Study This use design experimental laboratory on 25 animals mice diabetes - induced males using alloxan . Mice shared to in five groups , including control positive (metformin), control negative (NaCMC 0.5%), and three group therapy combination of metformin with extract Sargassum polycystum doses of 350 mg, 500 mg, and 650 mg. Measurements level glucose blood done in a way periodically use glucometer from day 0 to day 17, then the data was analyzed using One-Way ANOVA and Post Hoc Bonferroni tests	Evaluate effectiveness and dosage best extract Sargassum polycystum as therapy metformin companion in lower blood sugar	Combination extract grass sea and metformin are proven effective lower level glucose blood in diabetic mice . A dose of 500 mg is dose the most optimal adjuvant because capable lower blood sugar until to normal levels (93~mg/dl\$) without risk effect side effects . In contrast , the 650 mg dose showed the sharpest decline (81.1%) but very risky trigger hypoglycemia Because blood sugar levels down to below the normal limit (46.6~mg/dl\$).
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<p>10</p>	<p>Jae-Young Kim, Sejin Jang, Hyun Ji Song, SangHoon Lee, Sejin Cheon, Eun Jin Seo, Yi Hyun Choi, Sae Hun Kim.(14)</p>	<p>Scientific Reports , Vol. 14, Article number: 15064 (2024)</p>	<p>Sargassum horneri extract fermented by Lactiplantibacillus pentosus SH803 mediates adipocyte metabolism in 3T3-L1 preadipocytes by regulating oxidative damage and inflammation</p>	<p>Study in vitro experiments using cell cultures (HT-29 and 3T3-L1). Methods include fermentation Sargassum horneri , activity test antioxidant (DPPH), cytotoxicity test (MTT), analysis gene expression using RT-qPCR, inflammation assay (LPS-induced), as well as lipid analysis (Oil Red O staining)</p>	<p>Know effect extract Fermented Sargassum horneri to metabolism adipocytes , as well as evaluate activity antioxidant , anti-inflammatory , and anti-obesity potential</p>	<p>Research result show that extract Fermented Sargassum horneri (F-SHWE) has activity antioxidant , anti-inflammatory , and anti-obesity properties strong compared to without fermentation . F-SHWE is capable of lower stress oxidative and apoptosis of cells with pressing expression of genes such as NF- κB and p53, as well as reduce inflammation through decrease in IL-1β and IFN- γ. In cells adipocytes , F-SHWE is proven hinder fat accumulation and reduce expression of adipogenesis genes (PPARγ , C/EBPα) as well as lipogenesis (Akt, SREBP1). In addition , fermentation increase content acetate plays a role in repair cell metabolism . In Overall , F-SHWE has the potential as anti - obesity related agents with repair insulin sensitivity</p>
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<p>11</p> <p>Agung Giri Samudra, Fathnur Sani K, Moniq Chintama (15)</p>	<p>Journal Scientific Manuntung, 4 (1): 48-52</p>	<p>Comparison Test Effectiveness Antidiabetic Extract Polysaccharides and Compounds Brown Algae Polyphenols (Sargassum sp.) in Induced Mice Alloxan</p>	<p>Study This is experiments on induced mice alloxan extract polyphenols and polysaccharides from Sargassum sp. tested with share mice become four group (control negative , control positive, polyphenols , and polysaccharides). Glucose levels blood measured for 28 days and analyzed using ANOVA and LSD tests.</p>	<p>Study This aim For compare effectiveness extract polyphenols and polysaccharides from brown algae (Sargassum sp.) as antidiabetic in induced mice alloxan . This purpose important Because second compound the known own activity different biological , so that need it is known which is more effective in lower level glucose blood . In addition , research this also provides base scientific that Sargassum sp. potential developed as alternative therapy experience for diabetes.</p>	<p>Study This aim For compare effectiveness extract polyphenols and polysaccharides from brown algae (Sargassum sp.) as antidiabetic in induced mice alloxan , because second compound the own activity different biological so that need known which is the most effective in lower level glucose blood . Research results show that second extract capable lower level glucose blood in a way significant , with extract polyphenols give highest effect by 58.12%, followed by polysaccharides by 54.20%, and control positive (glibenclamide) of 42.86 % . statistics there is significant difference ($p \leq 0.05$), so that show that extract Sargassum sp. potential as antidiabetic natural , with polyphenols as the most dominant component its effectiveness .</p>
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<p>12</p> <p>Muhammad Firdaus, Ahmad Faris Priambodo(16)</p>	<p>Journal : Journal of Applied Pharmaceutical Science 16 (2): 070-076</p>	<p>Hypoglycemic Potential of Sargassum spp.: A Review of Bioactive Compounds for Diabetes Management</p>	<p>Study This use systematic review method with gather article from PubMed, Scopus, and Web of Science in the range 2014–2024 . Selection done based on criteria certain until 16 relevant pre- clinical animal studies were obtained . Data from each study Then analyzed in a way qualitative use PRISMA approach and assessed the quality with the Mixed Methods Appraisal Tool (MMAT). No meta-analysis was performed . Because existence difference design , dose , and methods between research , so that results served in form narrative .</p>	<p>Study This aim For evaluate potential hypoglycemic Sargassum spp. , identify compound bioactives that play a role , as well as understand mechanism his work in diabetes management . In addition , research this also aims For examine various results pre- clinical studies that have been there is a use for seeing consistency effect antidiabetic , comparing effectiveness between species Sargassum , as well as identify lack research that is still ongoing need developed as base For study further research , especially clinical trials in humans .</p>	<p>Study results show that various species Sargassum own potential as antidiabetic with capable lower level glucose blood , increase insulin sensitivity , and improve lipid profiles in test animals . Effects This happen through a number of mechanisms , such as inhibition enzyme digestion carbohydrates (α-glucosidase and α- amylase), increased absorption glucose through GLUT4, as well as activity antioxidants that reduce stress oxidative . Although the result consistent show effect positive , all proof Still originate from study animal with variation sufficient method big , so that required study continuation in humans For ensure its effectiveness and safety .</p>
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<p>13</p>	<p>Muhammad Firdaus Anies, Chamidah Annafi Riski Nurcholis, Siti Yulaikah Pangestuty, Yeni Anggraeni, Widya Adi Suryanata, Denny Alghafihqi, Rendi Hardiansyah(17)</p>	<p>Pharmaciana Vol. 7, No. 2, November 2017.</p>	<p>Effect of Sargassum polycystum extract on liver and kidney of diabetic rats</p>	<p>In Vivo Experimental Method Induction of diabetes in male Wistar rats using intraperitoneal streptozotocin for form a model of diabetes mellitus disease . - Treatment with Sargassum polycystum extract (ESP) and treatment control with glyclaside for 45 days .</p>	<p>Research purposes This For test effectiveness Sargassum polycystum extract (ESP) in reduce damage function and structure heart as well as kidneys in rats with diabetes mellitus . Research This aim For evaluate ability extract the in lower level glucose blood , reduce level malondialdehyde (indicator stress oxidative), repair level enzyme liver (SGPT and SGOT), lowering level creatinine blood , increase insulin levels , as well as repair structure histopathology liver and kidneys diabetic rats</p>	<p>Research result show that giving Sargassum polycystum (ESP) extract in diabetic rats is able to : - Lower level glucose blood . - Reduce level malondialdehyde (MDA) in the liver and kidneys , which is indicator level stress oxidative and damage consequence radical free . - Lower level serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT) enzymes as indicator damage heart . Reduce level creatinine blood that shows repair function kidney . Increase blood insulin levels , although No as high as in treatment glyclaside . Repair structure histopathology liver and kidneys , with decline level necrosis and fatty liver as well as subtraction glomerular damage and necrosis in the kidneys diabetic mice .</p>
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<p>14</p>	<p>Ratumas Ratih Puspita , Windi Utami , Rizki Handayani Fasimi , R. Yeni Mauliawati(18)</p>	<p>Nursing Analysis: Journal Of Nursing Research Volume: 5 Number : 1 Published : April 2025 Pages: 11-16.</p>	<p>Influence Effect of Seaweed Juice on Blood Sugar Levels: A Study in Diabetes Mellitus Patients Type 2 In Coastal Areas"</p>	<p>Methods used in study This is method quasi experiment with pretest and posttest design nonequivalent control group. Study use approach quantitative with two groups , namely group intervention given grass juice sea and group control that is not get intervention . The sample consisted of 60 respondents who were divided into two groups of 30 people each with non-purposive sampling technique . Measurement blood sugar levels done before (pretest) and after (posttest) giving grass juice sea for 7 days . Data analysis using the Wilcoxon test for test significance change blood sugar levels</p>	<p>Research purposes This is For know influence grass juice administration sea to blood sugar levels in patients with Diabetes Mellitus type 2 in coastal areas</p>	<p>Research result show that grass juice administration sea effective lower blood sugar levels in patients with Diabetes Mellitus type 2. In the group intervention given grass juice sea , happened decline significant blood sugar levels with p -value = 0.000, where the average blood sugar level decrease from 241.80 mg/dl to 197.90 mg/dl. Meanwhile, in the group control No happen significant decrease (p = 0.133) , with blood sugar levels only A little down from 270.27 mg/dl to 269.97 mg/dl. This indicates that grass juice sea effective in lower blood sugar levels in type 2 diabetes patients</p>
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15	Theodora Linggaryati , Gotama Amir Husni , Ustad(i(19)	Preventive Nutrition and Food Science Vol. 23 No. 3 (2018)	Antidiabetic Activity of Sargassum hystrix Extracts in Streptozotocin-Induced Diabetic Rats	Type of method used in study the is method experimental laboratory (experimental study) using Wistar rat test animals induced by streptozotocin (STZ). Study done with share mouse to in a number of group treatment, then given Sargassum hystrix extract with dose different For see its influence to level glucose blood, lipid profile, and histology pancreas .	Research purposes This is For know influence Sargassum hystrix extract against level glucose blood , lipid profile , and conditions pancreas in streptozotocin (STZ) -induced diabetic rats .	Research result show that Sargassum hystrix extract (SHE) at a dose of 300 mg/kg is dose best in lower level glucose blood fast and postprandial in streptozotocin (STZ) - induced diabetic rats . In addition, providing SHE also helps repair cell damage (necrosis) pancreas in diabetic rats . However , the extract the No give influence significant to lipid profiles such as HDL and LDL.
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4. Discussion

Based on the results of a literature review of various articles analyzed, it is known that *Sargassum* sp. has promising potential as a natural agent in increasing insulin sensitivity and helping control blood glucose levels. The majority of studies indicate that extracts and bioactive compounds from these brown algae can provide antihyperglycemic effects through various biological mechanisms. Research by Ditasari et al. (2022) showed that *Sargassum* sp. extract was able to reduce blood glucose levels by 22.37% [8], while research by Antameng et al. (2025) reported that the combination of *Sargassum polycystum* extract and metformin effectively reduced blood glucose levels in diabetic mice [13].

One of the main mechanisms by which *Sargassum* improves insulin sensitivity is through its polyphenol, flavonoid, and phlorotannin content. These compounds are known to inhibit carbohydrate digestive enzymes such as α -glucosidase and α -amylase, thereby slowing glucose absorption in the intestine and suppressing post-meal spikes in blood sugar levels. Research by Aunurrahman et al. (2024) showed that *Sargassum duplicatum* contains phlorotannin, which can inhibit the activity of α -glucosidase and α -amylase enzymes and increase glucose absorption in muscle tissue [5]. Similar results were also reported by Pawestri et al. (2021), who explained that the polyphenol content in *Sargassum* sp. acts as an antioxidant and can improve the function of pancreatic α cells in insulin production [12].

Other studies have shown that fucoxanthin, the main carotenoid pigment in brown algae, has significant benefits for glucose and fat metabolism. Fucoxanthin can increase insulin sensitivity by regulating protein expression in adipose tissue and helping reduce body fat accumulation. This is important because obesity is closely linked to insulin resistance in type 2 diabetes mellitus. Research by Sakka et al. (2025) explains that fucoxanthin has antioxidant, anti-inflammatory, anti-obesity, and anti-diabetic activities that play a role in regulating lipid and glucose metabolism [10]. Furthermore, Kim et al. (2024) reported that fermented extract of *Sargassum horneri* can reduce oxidative stress and inflammation, and inhibit fat accumulation in adipocytes, potentially improving insulin sensitivity [14].

The results of research by Firdaus et al. (2022) provide more specific evidence regarding the mechanism of action of *Sargassum* on the insulin pathway. In type 2 diabetic mice, *Sargassum olygocystum* extract was shown to reduce blood glucose levels, excess insulin levels, HOMA-IR values, and increase the expression of PI3K (Phosphoinositide 3-kinase) and Akt (Protein Kinase B) proteins. The PI3K/Akt pathway is a crucial component in insulin signaling, promoting GLUT4 translocation to the cell membrane, allowing glucose to enter the tissues. Activation of this pathway suggests that *Sargassum* may help improve insulin resistance and increase insulin sensitivity [9].

Furthermore, the same study by Firdaus et al. (2022) found that rhamnetin has a very strong binding affinity for the PTP1B (Protein Tyrosine Phosphatase 1B) enzyme. The PTP1B enzyme is known to inhibit insulin receptor activity, so increased activity is associated with insulin resistance. If this enzyme is inhibited, insulin activity can increase again. These findings suggest that *Sargassum* has the potential to be a source of natural PTP1B inhibitors that could be used as a future supportive therapy for diabetes [9]. These results are further supported by a review by Firdaus and Priambodo (2025), which explains that various *Sargassum* species can improve insulin sensitivity by increasing GLUT4 and antioxidant activity [16].

In other animal studies, administration of *Sargassum hystrix* and *Sargassum polycystum* extracts also showed positive results in improving diabetes. Research by Samudra et al. (2021) showed that *Sargassum hystrix* infusion had a significant antihyperglycemic effect, with a 5% concentration being the most effective dose in lowering blood glucose levels [11]. Furthermore, research by Firdaus et al. (2017) showed that administration of *Sargassum polycystum* extract was able to lower blood glucose levels, increase insulin levels, repair liver and kidney damage, and reduce oxidative stress in diabetic rats. These results indicate that the benefits of *Sargassum* are not limited to blood sugar control but also help protect organs from diabetes complications [17].

Although most studies show positive results, some studies still find inconsistent results. Research by Sahetapy et al. (2019) showed that administering *Sargassum* sp. extract did not significantly reduce blood sugar levels under acute stress conditions [7]. However, the study still noted that *Sargassum* contains bioactive compounds such as flavonoids, alkaloids, phenolics, and fucoxanthin, which have the potential to regulate glucose metabolism and insulin resistance. These differences in results are likely influenced by physiological conditions, research methods, extract dosage, and duration of treatment.

Overall, the literature review results indicate that *Sargassum* sp. is a marine natural ingredient with significant potential as a functional food and antidiabetic nutraceutical. Its bioactive compounds act through various pathways, ranging from inhibiting carbohydrate-digesting enzymes, protecting pancreatic β cells, increasing insulin sensitivity, antioxidant and

anti-inflammatory activity, to activating the PI3K/Akt pathway and inhibiting PTP1B. Therefore, Sargassum has the potential to be further developed as a natural complementary therapy in the management of type 2 diabetes mellitus

5. Conclusion

Based on the literature review, Sargassum sp. has the potential as a natural antidiabetes agent that can help improve insulin sensitivity and control blood glucose levels. This potential is supported by the presence of active compounds like polyphenols, flavonoids, fucosantin, and phlorotannin, which work in several ways. These compounds help by blocking the activity of enzymes alpha-glucosidase and alpha-amylase, improve glucose absorption through the activation of the PI3K/Akt pathway and the movement of GLUT4, protect pancreatic beta cells, reduce oxidative stress, and inhibit PTP1B activity, which is involved in insulin resistance. Most studies show a strong anti-hyperglycemic effect, although there are still some results that are not consistent. However, most of the available evidence comes from laboratory and animal studies, so clinical trials in humans are needed to confirm the effectiveness and safety of using Sargassum sp. as a complementary therapy for type 2 diabetes. Further research is needed to determine the best formulation, optimal dosage, and long-term safety of using Sargassum in the development of functional foods and nutraceutical products.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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