Abstract Glucose–galactose malabsorption is a rare inherited autosomal recessive genetic defect.One of the rare inherited autosomal recessive genetic defects is a mutation in the gene of SGLT–1 that will alter the transportation and absorption of glucose and galactose in the intestine and can be detected in the early days of life is responsible for neonatal deaths in many countries [11].The incidence differs in various populations due to the rarity of occurrence, with some increase in certain areas with higher rates of consanguinity, which supports the CGGM autosomal recessive mode of inheritance [12,19,21,26,27,28].None of the published studies included in this review discussed or specified the side effects of fructose consumption as a primary source of carbohydrates in congenital glucose–galactose malabsorption patients.Keywords: glucose–galactose malabsorption; fructose malabsorption; SLC5A1; SGLT1; metabolic syndrome; autosomal recessive genetic defects 1.It is a disaccharide formed of a condensation reaction between glucose and galactose, linking them together to form lactose; galactose is transported into the enterocyte by SGLT–1 and transported out to the bloodstream by GLUT2 [6].Diarrhea in CGGM disorder results from the accumulation of unabsorbed galactose and glucose in the lumen of the intestinal leading to delayed growth and development and severe malnutrition [22].Congenital glucose–galactose malabsorption (CGGM) is a rare autosomal recessive disorder driven by a galactose and glucose transportation defect across the small intestine [17].The numerous expected clinical indications of CGGM documented in other studies include abdominal distension, diarrhea, vomiting, and dehydration.The defect in the SGLT–1 leads to unabsorbed galactose, glucose, and sodium, which stay in the intestine, leading to dehydration and hyperosmotic diarrhea.Carbohydrates are a cover term that contains essential food groups such as fruits and vegetables, dairy products, fibers, and legumes.Then, through the gastrointestinal tract, monosaccharides are absorbed into the bloodstream, and the reaction causes the blood glucose levels to increase and some hormones to be secreted, like insulin.Human bodies consume other forms of sugar besides glucose, such as galactose and fructose (monosaccharides), lactose and sucrose (disaccharides), or starch (polysaccharides).The defect in the SGLT–1 leads to unabsorbed galactose, glucose, and sodium, which stay in the intestine, leading to dehydration and hyperosmotic diarrhea [29,30].A mutation in the glucose sodium–dependent transporter–1 gene will alter the transportation and absorption of glucose and galactose in the intestine.This study aims to investigate all published studies on congenital glucose–galactose malabsorption and fructose malabsorption.Glucose transporters have many differences like tissue type, affinity, and capacity, but the central aspect of difference is the reliability of sodium.The first one is sodium–dependent glucose transporter–1 (SGLT–1), using the active transport method, and the second type is sodium–independent glucose transporter (GLUT) which uses facilitated diffusion [6].Through the molecular analysis process, one of the responsible genes is solute carrier family 5 member 1 (SLC5A1), with a genetic mutation in chromosome 22q13.1 responsible for this defect.SLC5A1 gene mutation generates the nonfunction of SGLT–1, which is primarily expressed in the intestine brush border membrane [23,24,25].This study aims to investigate all published studies on congenital glucose–galactose malabsorption and fructose malabsorption.Usually, fructose gets out of the cytosol and enters the bloodstream with GLUT2, a high–capacity, low–affinity transporter [8].Studies show the prevalence of glucose–galactose malabsorption (GGM) cases in the Arabic region [12].Carbohydrate intolerance

can result from gastrointestinal malabsorption or, more rarely, from systemic metabolic defects.Clinically, carbohydrate intolerance leads to malabsorption; this occurs in about half of all patients with unspecific food side effects and is often misinterpreted as an allergy.Consequently, it is difficult for healthcare providers to reflect on CGGM disorder as their initial diagnosis.Metabolic disorders affect the nature of the life of the patients also the patient's families in many ways, including the social life by being limited to a specific diet and losing the ability to consume meals regularly, and being unable to share meals with others.The psychological level of the patient and the patient's family may be affected due to the patient's altered lifestyle, the fear of further negative progression of the condition, and frequent visits to healthcare facilities.Glucose can be stored in the human body as a glycogen polymer which can be used in a time of need energy can be provided through a process called glycolysis which is based on the utilization of glycogen back to glucose.GLUT5 (SLC2A5) is the primary fructose transporter required to absorb fructose in the intestine [7].High fructose consumption had some effects on health, and some studies showed that high fructose consumption showed increased hepatic insulin resistance [9].Some of the diagnostic methods of CGGM are somewhat limited, and the application of these diagnostic procedures is not available in all countries.GGM can be diagnosed through blood sugar levels and sugar chromatography tests, which show glucose and galactose in the stools [15].Due to the rapid passage of carbohydrates through the gastrointestinal tract, symptoms often begin as early as 30 min after ingestion; they can stay for 6 to 9 h after eating.Nevertheless, if the CGGM patient could not be diagnosed and treated immediately, there might be a need for a bowel biopsy and total parenteral nutrition.Some studies report that CGGM disorder could be inaccurately diagnosed due to hematuria and polyuria.Often, glucose–galactose malabsorption patients are highly dependent on fructose, their primary source of carbohydrates.One hundred published studies were assessed for eligibility in this study, and thirteen studies were identified and reviewed.Carbohydrate malabsorption can be detected via a hydrogen exhalation test [4].Glucose is the human body's essential energy source in aerobic and anaerobic cellular respiration [1].Among all other natural carbohydrates, fructose has the sweetest taste; thus, it is used as a sweetener in many food products.Also, high fructose consumption showed increased hepatic lipogenesis, which leads to more cardiometabolic effects [10].Most patients responded positively when the formula was changed to a fructose–based one because GGM patients have normal fructose absorption [16].GGM is a rare genetic disorder affecting a few of our populations and is responsible for some deaths in newborns in early life. The symptoms of patients with carbohydrate malabsorption are caused by a lack of breakdown or absorption of carbohydrates in the intestinal lumen [4]).Usually, symptoms occur post–feeding, including flatulency, nausea, diarrhea, and unspecific abdominal pain.Occasionally, constipation, weight loss, or extraintestinal symptoms (e.g., fructose malabsorption headache) may be noted.The treatment goals for carbohydrate malabsorption are to stop the intake of the responsible carbohydrate substance or decrease it to an amount patients can tolerate [4].The early detection of the symptoms and the diagnosis of this metabolic disorder are crucial because the earlier detection, the better management can be provided [12].That usually arises in newborns with severe osmotic–type dehydration and diarrhea [19,20,21].Thus, the expected characteristics of CGGM are severe dehydration, diarrhea, and weight loss.Luckily, punctual therapy and precise diagnosis are

lifesaving, and the child will be able to grow well into adulthood.Thus, when healthcare providers suspect CGGM, they must diagnose it quickly and accurately [15].Studies showed that high fructose consumption has many health effects and could generate life-threatening complications.Glucose (C6H12O6) is the simplest carbohydrate in the world, and all living organisms are highly dependent on this monosaccharide.It is the process of generating glucose from non-carbohydrate sources such as fat and protein.This shows us the importance of glucose to the human body and its vital role in maintaining homeostasis [1].Galactose is a monosaccharide found in dairy products in the form of lactose.The only management that can be applied in avoiding glucose and galactose in the diet and focusing on fructose.CGGM is an autosomal recessive disorder first defined in 1962 [18].Introduction Carbohydrates are one of the three core nutrients the human body needs in our daily diet, besides fat and protein.Carbohydrate metabolism takes place in different sites throughout the human body systems.Carbohydrate malabsorption consists mainly of two types.Also, dehydration is common among patients with GGM, and usually, fail to thrive state is common among them as hypernatremia.The earlier GGM is detected, the better the patient can avoid complications like kidney injury and nephrolithiasis.In gastrointestinal intolerance, a distinction is made between simple and complex carbohydrates.The most common adverse food reactions occur with simple carbohydrates.Eventually, this might lead to severe infection due to malnutrition and long-term total parenteral nutrition [31].Further complications might occur as well, such as kidney injury, nephrolithiasis, and hypercalcemia [32,33].Common symptoms are highly categorized, and the way of CGGM diagnosis is also not specified.The first one is caused due to a rare inborn genetic defect; the second type is related to a pathological condition.The cost of all types of therapies may affect the economic status, and the life binding of the patients may require a permanent change in the diet at a high price.Another process of glucose synthesis is gluconeogenesis [5].Those reactions occur in the fasting state.Parents of many cases were found to be related by blood, which can be related to inheriting the heterogeneous gene responsible for GGM [13,14].Most cases are Arabs, especially in Saudi Arabia [12].The best therapy for CGGM is feeding a fructose-based formula.It makes up about 45% to 65% of our calorie intake [1,2,3].The digestion starts in the mouth with salivary amylase.In some cases, the patient may require staying for long periods admitted to the hospital, which will be stressful for both the patient and the family.There are two main types of glucose transporters.Fructose is one of the three simple monosaccharides.Watery diarrhea symptoms that patients will suffer from when the feeding starts.It was estimated that there are around 300 cases known worldwide.2.