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Gopal Lal
Director, ICAR - National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan India

Neha Shekhawat
YP-1, ICAR - National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan, India

Swati Yadav
Nutritionist (Free Lance), Evanston, Illinois, USA

Mahendra Kumar Choudhary
SRF, National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan, India

Meenakshi Bhatiya
Nutritionist at Acharya Tulsi Regional Cancer Treatment and Research Centre, Bikaner, Rajasthan, India

Corresponding Author:
Gopal Lal
Director, ICAR - National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan India

Guar gum valuable for pharmacological and pharmaceutical conscious: A review

Gopal Lal, Neha Shekhawat, Swati Yadav, Mahendra Kumar Choudhary and Meenakshi Bhatiya

Abstract
Guar gum is derived from the seeds of the drought-tolerant plant *Cyamopsis tetragonoloba*, a member of the Leguminosae family. The primary constituent of guar gum is a Galactomannan which is composed of galactose and mannose in a ratio of 1:2 that provides the main physical phenomenon of gelling or thickening to this gum. Partially hydrolyzed guar gum (PHGG) is a water-soluble, non-gelling dietary fiber with an ample range of uses in clinical nutrition. Industrial applications of guar gum are due to its ability to form hydrogen bonding with water molecules. It is also beneficial in the control of many health problems like diabetes, bowel movements, heart disease, low immunity and colon cancer due to its dietary fiber action. Guar gum is natural polymer encumbered with potential applicability in pharmaceutical formulations due to its unique chemistry and be short of of toxicity. This article focuses on the composition, health benefits and use of guar gum as a rate controlling recipient in designing novel drug delivery systems of guar gum.

Keywords: guar gum, industry, health, pharmacological, pharmaceuticals, drug delivery

Introduction
Gum is plant exudes and they are often misunderstood with the resin, rubbers, and latex. So specifically, gums are those substances which can be dissolved and dispersed in water to form more and less viscous colloidal solution. Guar gum, in nature carries gum, also called Guaran, is a galactomannan. Which is obtained from an annual pod bearing plant *Cyamopsis tetragonolobus* or *C. psoraloides*, belonging to Leguminosae family [1-2]. It is a white to yellowish-white in color, odourless and is available in different viscosities and different granulometries. The common names used in the scientific literature for the cluster bean, guar gum and the galactomannan fraction are Indian cluster bean, guar, and guaran, respectively. There is a lack of consensus about the origins of this plant [3] although the concept of trans domestication was originally proposed by [4]. Guar gum endosperm contains a complex polysaccharide called galactomannan, which is a polymer of d-galactose and d-mannose. This hydroxyl group rich polymer, when added to water, forms hydrogen bonding imparting considerable viscosity and thickening to the solution. Due to its thickening, emulsifying, binding and gelling properties, quick solubility in cold water, wide pH stability, film-forming ability, and biodegradability, it finds applications in a large number of industries [2]. Partially hydrolyzed guar gum (PHGG) is a vegetal, water-soluble, non-viscous, non-gelling dietary fiber that is derived from guar gum, a water-soluble, viscous, gelling polysaccharide found in the seeds of the guar plant. The saccharide component of guar gum is galactomannan [5]. Its low viscosity allows its use in enteral products and beverages. PHGG can be supplemented to enteral formulas and food products as a dietary fiber source. PHGG provides the benefits associated with dietary fibre ingestion [6]. The Food and Drug Administration (FDA) considers it to be generally recognized as safe for consumption in specified amounts in various food products. Guar cultivation is suitable for semiarid areas, but recurrent rainfall is necessary. This legume is a valuable plant in a crop rotation cycle, as it lives in symbiosis with nitrogen-fixing bacteria [7]. Agriculture practitioners in semi-arid regions of Rajasthan (India) pursue crop-rotation and use guar to replenish the soil with essential fertilizers and nitrogen fixation, before the next crop. About 80% of world production occurs in India and Pakistan, but due to strong demand, the plant is being introduced elsewhere. In India, it is grown in Rajasthan, Gujarat, Haryana, and Uttar Pradesh. In India, Rajasthan holds first in terms of area and production of cluster bean. Guar has many functions for human and animal nutrition, but the gelling agents in its seeds (guar gum) are the most important use [8]. Demand is intensifying due to the use of guar gum in hydraulic fracturing (oil shale gas). Guar gum is frequently used as food additive in many processed food [9].

The purpose of this review is to summarize the research data related to effect of guar gum on human health. Widespread data are available associated to the effect of consumption of guar gum supplements on serum lipid values, weigh management, post prandial glulose level, gastrointestinal health, immunity and guar gum as drug carrier. Thus the general implication of guar gum consumption and the potential health outcomes will be examined.

Composition and properties of guar gum

Guar gum is a high molecular weight polysaccharide with white to yellowish-white appearance and odourless acquired from the guar plant. Hydrocarbons, fats, alcohols, esters, and ketones do not dissolve the guar gum but with few exceptions (e.g. formamide) in organic solvents. The only important solvent for guar gum is water. It has excellent thickening, emulsion, stabilizing and film-forming qualities. It is compatible with a variety of inorganic and organic substances including certain dyes and various constituents of food [10].

Guar gum constitutes the example of hydrophilic polysaccharides. They have a rod-like polymeric structure in which galactose side chains are linked on the mannose backbone with an average molecular ratio of 1:2. Straight chains of D-mannose units are linked together by β (1–4) glycoside linkage and D-galactose units are joined alternately through (1–6) glycoside linkage. Hydroxyl groups present in the polymeric structure help in the manufacturing of various derivatives utilized for various industrial applications. Fig. 1 shows the structure of guar gum and the overall chemical composition of guar gum with their relative percentage has been presented in Table 1. Which clearly characterize that water-soluble polysaccharide makes the highest concentration of guar gum which enables guar gum to pay effective role in human health. Structure and chemistry of guar gum can be determined using various techniques such as chemical tests (acid hydrolysis, methylation, and formation of tolyl sulphonyl-derivative), analytical tests (chromatography, scanning electron microscopy, nuclear magnetic resonance, R-ray diffraction and Infra-red spectroscopy), biological test (selective enzyme hydrolysis) and physical tests (optical rotation, stress-strain measurement, and X-ray analysis) [11]. It is the naturally occurring water-soluble polysaccharide with the highest molecular weight naturally. Its properties mainly depend upon the chemical features like chain length, an abundance of cis–OH groups, steric hindrances, degree of polymerization and presence of substituents, etc. Advanced techniques have concluded that the number average molecular weight of guar gum lies in the range of 10^6 to 2×10^6 g/mol.

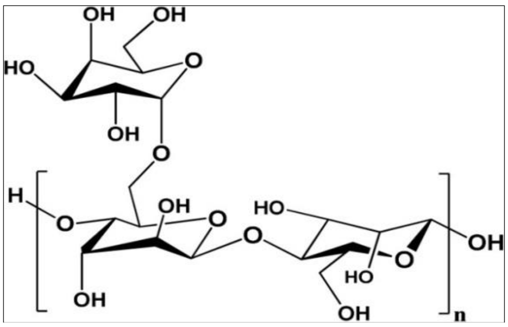

Fig 1: Structure of guar gum, "Mudgil *et al.* [8]"

Table 1 represents the chemical composition of guar gum. Which clearly characterize that water soluble polysaccharide makes the highest concentration of guar gum which enables guar gum to pay effective role in human health.

Table 1: Chemical composition of guar gum

S. No.	Constituents	Percentage
1.	Nitrogen	0.67
2.	Protein	3.5-4.0
3.	Phosphorus	0.06
4.	Ash	1.07
5.	Water soluble polysaccharides	88.50
6.	Water insoluble fraction	7.75
7.	Alcohol soluble fraction	1.50

"Chudzikowski RJ, [7]"

Guar gum based multifunctional properties carrying supramolecular hydrogel is critical for the formation of borate/didiol bonds. The FT-IR and XRD analysis verified the existence of boronate ester interactions between borax and guar gum. Moreover, the viscoelastic and mechanical behaviours of the hydrogels with different guar gum concentrations showed that the storage modulus and compressive stress were highest at guar gum concentration of 2 wt %. Besides, due to the vibrant and reservable properties of boronate ester, these guar gum-based hydrogels had excellent self-healing property, outstanding reformable and injectable capability. Multifunctional guar gum based hydrogels can expand their potential applications in various fields [12].

Research activities of valuable guar gum for pharmacological properties

Guar gum and pharmacological benefits

Various studies have been conducted on animals to test for both harmful and beneficial effect of guar gum. Guar is completely degraded in the large intestine by *Clostridium butyricum*, [13]. Harmful effects are observed only when the guar gum is given to the animals at a high concentration of about 10–15% on weight basis. This high concentration will reduce growth of animal due to decreased feed intake and impaired digestion. It is considered that the high viscosity of the intestinal tract contents, resulting from intake of guar gum at higher concentration, is the major cause of the negative effects. Thus, the general implications of guar gum consumption will be reviewed and the potential health benefits of specific guar gum foods and supplements will be examined.

Guar gum in digestive health

22% of Indian adult population suffers from constipation [14]. Guar galactomannan was enzymatically hydrolyzed to obtain partially hydrolyzed guar gum which can be able to utilize as prebiotic resource. Outcomes of the study propose that partially hydrolyzed guar can be considered as potential prebiotic composite that may further encourage the growth of potentially probiotic bacteria or native gut micro flora [15]. Partially hydrolyzed guar gum (PHGG) is a water-soluble, non-gelling dietary fiber with an ample series of uses in clinical nutrition. PHGG consumption till four week accelerates colon transit time in patients with chronic constipation, especially in those with slow transit, and improves several of their symptoms including incidence of bowel movements [16].

In an adult open trial, PHGG supplementation is followed by a decrease of IBS symptoms, such as abdominal pain and bowel habit [17-18]. In a small, prospective, randomized, double-blind, controlled trial has revealed that fiber supplementation can improve symptoms in children with FAP [19]. PHGG, similar to other dietary fibers, increases the concentration of Bifidobacterium in feces from 14.7% to 31.7%. The ability of dietary fiber to alter the gut microflora is considered as a prebiotic type effect that may improve colonic immunologic status [20]. The beneficial effects of PHGG in 15 women were clearly indicated that PHGG treatment in patients resulted in soft feces, thus increasing the defecation frequency of severely constipated patients [21]. PHGG supplementation to the diet also reduces the laxative requirement, incidence of diarrhea and symptoms of irritable bowel syndrome [20, 22]. For treatment of irritable bowel syndrome water soluble non-gelling fibers are preferred. Due to its water solubility and non-gelling behavior, partially hydrolyzed guar gum decreased the symptoms in both forms of irritable bowel syndrome i.e. constipation predominant and diarrhea predominant [23]. *In vitro* study showed that presence of guar gum significantly decreases the digestion of starch. It acts as a barrier between starch and starch hydrolyzing enzymes [24].

Treatment through partially hydrolyzed guar gum is as efficient as lactulose treatment in relieving stool withholding and constipation-associated abdominal pain, and its use improves stool consistency. Lactulose seemed to have more side effects, including flatulence and sensation of bad taste [25]. Addition of PHGG to the diet declined laxative dependence in nursing home patients. PHGG also reduced the occurrence of diarrhea in septic patients receiving total enteral nutrition and reduced symptoms of irritable bowel syndrome. PHGG also increased production of Bifidobacterium in the gut [20]. The gut relief formula generally improved microbial profile, with a noticeable raise in Lactobacillus, Clostridium, and Faecalibacterium prausnitzii [26].

Partially hydrolysed guar gum after fermentation in colon results short chain fatty acids, implicated in the main pathophysiological mechanisms responsible for their clinical effects. Diarrhoea occurred due to enteral nutrition is supported by several studies and by the recommendations of scientific societies such as the European Society for Clinical Nutrition and Metabolism and the American Society for Parenteral and Enteral Nutrition [27].

Guar gum in diabetes

Diabetes currently affects more than 62 million Indians, which is more than 7.2% of the adult population of the country [28]. Nearly 1 million Indians die due to diabetes every year [29]. One in six people with diabetes in the world is from India. The numbers place the country among the top 10 countries for people with diabete, coming in at number two with an estimated 77 million diabetics [28].

Many studies showed the effect of guar gum on glycemic control and serum lipid and lipoprotein profiles in mildly hypercholesterolemic patients with insulin-dependent diabetes. Guar gum can recover glycemic control and decline serum LDL-cholesterol levels in mildly hypercholesterolemic insulin-dependent diabetic patients and hence shrink risk factors for both micro- and macroangiopathic complications. The intake of partially hyrolllyzed guar gum reduces the post-prandial blood glucose absorption in small intestine and glucose level in systemic circulation [30].

The effects of dietary supplementation with granulated guar gum on mean serum total cholesterol and LDL-cholesterol concentrations were appreciably lower during the guar gum supplementation, whereas the HDL-cholesterol level remained unaffected. Long-term administration of guar gum induced a sustained improvement in diabetic control in Type 2 diabetes [31]. In patients with type two diabetes and the metabolic syndrome, the addition of PHGG to the usual diet improved the metabolic syndrome profile and factors associated with cardiovascular risk by reducing WC, HbA1c, UAE and trans-FA. This soluble fibre consumption might be included in the dietary management of type 2 diabetic patients [32].

In the small bowel, clinically meaningful health benefits (eg, cholesterol lowering and improved glycemic control) are highly correlated with the viscosity of soluble fibers. High viscosity fibers (eg, gel-forming fibers such as b-glucan, psyllium, and raw guar gum) exhibit a significant effect on cholesterol lowering and improved glycemic control [33].

Both whey and whey/guar preloads reduced postprandial glycemia, associated with slowing of gastric emptying. Low dose guar was less effective as a preload for glucose-lowering and did not slow gastric emptying [34].

Guar gum in lowering cholesterol

Cholesterol and glucose lowering property are most frequently coupled with gelling, mucilaginous, and viscous fibers such as guar gum, an edible thickening agent. The demand for guar gum is mounting speedily because in addition to its obligatory role in lowering serum cholesterol and glucose levels, it is also painstaking helpful in weight management. A well known range of studies have shown an active association between diets loaded in soluble dietary fibres (SDF) such as β-glucan, pectin, guar gum and psyllium, and reduced serum cholesterol and thus a decreased risk of cardiovascular disease (CVD). Three foremost biological mechanisms have been anticipated to reveal the cholesterol-reducing effects of SDF: prevention of bile salt (BS) re-absorption from the small intestine leading to an excess faecal BS excretion; reduced glycemic response leading to lower insulin stimulation of hepatic cholesterol synthesis; and physiological effects of fermentation products of SDF, mainly propionate. Whereas, glycemic responses to SDF have been studied widely, the nature of connections between bile salt micelles and SDF that lead to incomplete BS re-absorption are poorly defined [35]. In obese patient's guar gum produced a reduction in serum cholesterol (from 7.70 +/- 0.90 to 6.41 +/- 1.11 mmol l-1, p less than 0.01) due to an effect on low density lipoproteins. These differential effects may be important in planning therapy when hyperlipidemia accompanies Type 2 diabetes [36].

Mechanism behind cholesterol lowering by guar gum is due to increase in excretion of bile acids in faecus and decrease in enterohepatic bile acid which may enhances the production of bile acids from cholesterol and thus hepatic free cholesterol concentration is reduced [37]. Hypotriacylglycerolaemic effects are due to decrease in absorption of dietary lipids and reduced activity of fatty acid synthase in liver [38]. Toxicity study on partially hydrolyzed guar gum has revealed that it is not mutagenic up to dose level of 2500 mg/day [31].

Guar gum in weight management

The prolonged consumption of PHGG may significantly reduce energy intake from whole-day snacking. PHGG could be a principle natural soluble fibre for delivering sensitive and long-term satiety effects for pleasant appetite control [39]. Due to gel forming capacity of guar gum soluble fiber, an increased satiation is achieved because of slow gastric emptying [40]. Diet supplemented with guar gum decreased the appetite, hunger and desire for eating [41]. Thus guar gum controls the diet portion size of an individual which helps in weight management.

Guar gum as antibacterial

Nature-friendly purposeful bionanocomposite films were equipped with sodium caseinate and guar gum as the polymer matrix and cumin essential oil and TiO_2 as functional fillers. 0.2 vol% guar gum selected for the preparation of sodium caasinate and guar gum composite film and various amount of TiO_2 and cumin essential oil (1 and 2 wt% based on sodium casinate) were incorporated into the sodium casinate/guar gum film either individually or in combination. The sodium casinate/guar gum films incorporated with TiO_2 and cumin essential oil exhibited remarkable antibacterial activity against both Gram-positive (L. monocytogenes and S. aureus) and Gram-negative (E. coli O157: H7 and S. enteritidis) bacteria [42].

Guar gum and immune system

The gastrointestinal tract is the largest immune organ for humans. The gut-associated lymphoid tissue contains about 60% of all lymphocytes in the body and includes the Peyer's patches and other non-aggregated and intracellular lymphocytes [43]. Optimal function of the gut immune system is dependent on dietary constituents, especially prebiotics (substances that stimulate growth of health-promoting bacteria in the colon) [44-45]. Most prebiotics are nondigestible carbohydrates that are fermented in the colon. The guar-gum nanoparticle findings indicated that the guar gum nanoparticles can be utilized for safe and effective vaccine delivery via oral route [46]. Water soluble dietary fibres (including guar gum) indirectly enhanced the Immunoglobulin production of lymphocytes [39]. Nondigestible carbohydrates are fermentation substrates in the colon after escaping digestion in the upper gastrointestinal tract. Non starch polysaccharide such guar gum can also be fermented by beneficial bacteria in the large intestine. Butyrate is one of the most significant metabolites produced through gastrointestinal microbial fermentation and functions as a key energy source for colonocytes by directly affecting the growth and differentiation of colonocytes. Moreover, butyrate has various physiological effects, including enhancement of intestinal barrier function and mucosal immunity [47].

A diet of fibre mixture (guar gum and cellulose) in uniform concentration supplemented during gestation. Results indicated that purified fibre mixture was able to improve sow reproductive performance through a mechanism potentially linked with a bias towards type-2 helper T-cell differentiation that supported embryonic survival and thereby improve reproductive yields. Changes in metabolites produced by the intestinal microbiome may thus have an impact on host immunity and reproductive performance [48].

Growths of probiotics (Lactic Acid Bacteria strains) were studied with native guar gum glucose and partially hydrolyzed guar gum. All the strains (six) were galactose &/or mannose positive using the API CHl 50 test. Almost all these strains demonstrated an ability to embrace partially hydrolyzed guar gum with respect to increase in optical density and viable cell count with simultaneous decline in the pH of the growth medium. Streptococcus thermophilus MD2 demonstrated higher growth (7.78 log cfu/ml) while P. parvulus AI1 showed relatively less growth (7.24 log cfu/ml) as compared to used lactobacillus and Weissella strains. Consequences of the current study recommend that partially hydrolyzed guar can be considered as prospective prebiotic compound that may further encourage the growth of potentially probiotic bacteria or native gut microflora [15].

Guar gum as drug carrier

Embelin-loaded guar gum microparticles through emulsification technique was developed. The *in vitro* release of the optimised formulation was found to be 88.5 ± 3.8% in 24 h, has presented extraordinarily sustain and deferred the release of embelin at a specific site. The *in vivo* study concluded that pre-treatment of embelin prevents dinitrobenzene sulfonic acid (DNBS)-induced colitis in rats and portrays protective activity against ulcerative colitis due to its antioxidant and anti-inflammatory actions. This approach produces comparatively less side effect to another conventional dosage form [49]. The blend of new generation semi-interpenetrating (s-IPN) hydrogels from carboxy methyl guar gum (CMGG) and gelatin with boosted gel properties for appropriate drug delivery applications. The hydrogels were hemocompatible, non-cytotoxic and suitable for applications in physiological environment. Model drug ciprofloxacin was encumbered within the hydrogels and the drug release was found to be a combination of both diffusion and hydrogel degradation. New generation s-IPN biopolymer hydrogels of carboxymethyl guar gum and gelatin grasps assurance for its application as sustained drug delivery device or alternatively as hydrogel sorbents for bio-toxins and molecules of biomedical importance [50].

Pharmaceutical activities of valuable guar gum

Guar gum in antihypertensive drug delivery

Guar gum helps in sustaining the release of anti-hypertensive drug which are mainly hydrophilic in nature. Many scientists have investigated the use of guar gum as controlled release matrix for anti-hypertensive drugs such as nifedipine and diltiazem hydrochloride [37-38] Matrix tablets of Diltiazem hydrochloride have been prepared using various viscosity grades of guar gum by wet granulation method for oral controlled release [39] The bioavailability profile showed that there was a constant and minimum fluctuation in drug delivery. A water soluble drug, Metoprolol tartarate was formulated into three layered matrix tablet. The results obtained from the study indicated that GG was a potential hydrophilic carrier for oral controlled drug delivery system.41 Recently the controlled release of calcium channel blockers like verapamil hydrochloride and Nifedipine microsphere were formulated by using the glutaraldehyde cross-linked poly(acrylamide)-g-GG (PAm-g-GG) hydrogel microspheres were studied [42–44]. In these studies, the incorporation of drugs was done either during dissolving the cross linking agent by the soaking technique. On the basis of dynamic swelling studies it was found that with an increase in cross-linker, water transport diverges from Fickian to non-Fickian mechanism. The hydrogel microspheres showed a swelling followed by diffusion controlled drug release mechanism. Spherical shaped cross-linked microgels of PAm-g-GG possessing weakly anionic groups were prepared by the emulsification method [45].

Guar gum Applications in Protein Delivery

Usually the protein is delivered parenterally due to its instability problems related to degradation in the acidic environment of the GI tract. In order to achieve successful oral delivery of protein drugs, there is need to protect it from acidic environments. Due to increase in pH, the degree of swelling of these hydrogels increases as they pass from stomach to the intestinal tract [56]. George *et al*. designed a pH sensitive alginate–GG hydrogel cross-linked with glutaraldehyde for the controlled delivery of protein drugs [57].

Guar gum application in Colon-Specific Drug Delivery
Guar gum is mainly considered as a good and versatile candidate for colon-specific drug delivery application due to its drug release retarding behaviors and susceptibility to microbial degradation in large intestine. This is mainly used for the delivery of drug for the treatment of diseases associated with the colon which reduces the side effects and also the dose needed to reduce the dosing frequency.

Guar gum applications in Bead Forms
Ionic cross-linking of sodium Carboxymethyl GG (CMG) is used for microencapsulating sensitive drugs like proteins. When a solution of sodium salt of CMG, containing bovine serum albumin (BSA) as a model drug is added drop wise drop, to different bivalent metal ion solutions, for cross-linking purpose to form insoluble microbeads. The amount of protein present, their surface morphology of beads and the subsequent release of the retained protein in simulated intestinal fluids varied with the type of metal ion as well as its concentration. Many metal ions like Al3+ and Fe3+ were found to be superior in protein delivery as compared to divalent metal ions like Ba2+, Ca2+, Cu2+ and Cd2+. The optimum concentration of these ions provides maximum drug retention and was found to be much lower for trivalent ions. Crosslinkedmicro beads release the protein over a longer duration in enzyme free simulated intestinal fluid, as compared to crosslinked with divalent ions [72]. Gupta *et al*. have studied on cross-linked alginate–GG beads which show affinity for purification of jacalin [73]. The presence these beads indicate in binding of jacalin, with maximum binding capacity of 35×104 U ml−1. The dynamic binding capacity of 5% GG reflected efficient loading of the lectin.

Guar gum applications in Hydrogels
Hydrogels are crosslinked polymeric networks, which have the capacity to hold water within the spaces available among their polymeric chains. The hydrogels have been used in various biomedical applications for controlled drug delivery, entrapment of cells, wound management and tissue engineering. The hydrogels obtained by chemical network based on GG cross-linked with PVA and glutaraldehyde appears to be a good and compatible matrix for drug delivery [75 -76]. The increase in percent of GG content in hydrogel reduces the swelling ratio while increase in addition of acrylic acid content led to increase in swelling ratio [77].

Guar gum applications in Nanoparticles
Nanoparticle drug delivery systems are nanometer carriers used for delivery of drugs or biomolecules. Generally, nanometer carriers consist of of nano particles having size below 1000 nm and with a range of morphologies like nanospheres, nanocapsules, nanomicelles, nanoliposomes, etc. [85-86]. Rema Sreenivasan *et al*. have equipped selenium integrated GG nanoparticle by using nanoprecipitation technique [87]. AbdelHalim *et al*. reported the preparation of silver nanoparticles (AgNPs) using PAm-g-GG copolymer [88]. There were reports of nano-silica composites such as vinyl modified guar gum-silica nanocomposites [89-90].

Conclusion
In a review found that the guar gum is largely used in the form of guar gum powder as an additive in food, pharmaceuticals, paper, textile, explosive and oil well drilling as well as cosmetics industry. Guar bean is a legume crop and one of the popular vegetables known as 'guar fali' in India. Guar bean is cultivated for its green vegetable, pods, forage crop and green manuring. India is holding the top position in production and export of guar in the world market, 80 % of global demand is met by India. Guar is principally simple, short & easy rain fed (no irrigation) crop and cultivated in Rajasthan & Haryana state, but it can be grown successfully in other states (Andhra Pradesh, Karnataka and Tamil Nadu) also.
Digestive health plays key role in our active daily life; but maintaining proper bowel movements, *i.e.*, being free from constipation, diarrhea, irritable bowel syndrome, inflammatory bowel disease, flatulence, bloating, and abdominal pain, is complex. Dietary fibers often are recommended to maintain proper digestive health, but none seems to provide a single comprehensive solution for overall maintenance of proper digestive health. Guar fiber, though, has emerged as a credible aspirant for just such a solution. Except digestive health guar gum also demonstrated remarkable role in diabetes, weight management, hypercholestremia, immunity and antibacterial activity.
Guar gum is a polysaccharide belonging to the group of galactomannans. Polysaccharides have been finding, in the last decades, very interesting and many useful applications in the biomedical and specifically, in the biopharmaceutical field. The conventional use of guar gum as excipients in drug delivery products generally depends on the thickening, gel forming and stabilizing properties. A call for for prolonged and better control of drug administration has increased the demand for tailor made polymers. Several significant works have been carried out in physical and chemical modification of guar gum to make the formulation sustained and targeted. Steadily increasing number of researcher has been engaged in exploring guar gum due to its flexible chemistry, easy availability, and enormous applications. Their unique properties have made significant contributions to many types of formulations and suggest that the potential of guar gum as novel and versatile. Therefore, in future, there is going to be continued interest in the guar gum and its derivatives with the aim to have better materials for drug delivery systems. This review will hopefully provide some knowledge to the researchers who having some interest in natural excipients.

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