

BIBLIOGRAPHY: NUTRITIONAL ASPECTS OF ACACIA FIBER

1: J Nutr 1978 Apr;108(4):630-9 // Kelley JJ, Tsai AC.

EFFECT OF PECTIN, GUM ARABIC AND AGAR ON CHOLESTEROL ABSORPTION, SYNTHESIS, AND TURNOVER IN RATS.

A series of five experiments was conducted to determine the effect of pectin, gum arabic and agar (5%) on cholesterol absorption, biosynthesis and turnover in rats. In the study of cholesterol absorption, a tracer dose of labeled cholesterol was included in the last meal. The rats were killed 12 hours later. The proportion of the labeled cholesterol recovered in the whole body was used as an estimation of the efficiency of absorption of dietary cholesterol. Cholesterol biosynthesis was estimated by determining the activity of labeled diglucosyl-precipitable sterols biosynthesized from labeled glucose which was included in a test meal. In turnover studies, rats were injected intravenously with labeled cholesterol using serum as a vehicle, and the activity of labeled cholesterol in tissues was determined after various time intervals. All three complex carbohydrates decreased cholesterol absorption and pectin had the greatest effect. Pectin and gum arabic increased cholesterol biosynthesis in rats fed a cholesterol-containing diet, but had no effect in a cholesterol-free diet. Pectin slightly increased the turnover of cholesterol, but gum arabic and agar had no effect. This work supports the hypothesis that pectin lowers cholesterol levels by interfering with cholesterol absorption and by increasing cholesterol turnover. The study also suggests that complex carbohydrates differ in their effects on cholesterol metabolism. The reason for these differences remains to be determined.

2: Br J Nutr 1982 Jul;48(1):97-110 // Frappe DL, Wayman BJ, Tuck MG, Jones E.

EFFECTS OF GUM ARABIC, WHEAT OFFAL AND VARIOUS OF ITS FRACTIONS ON THE METABOLISM OF 14C-LABELLED AFLATOXIN B1 IN THE MALE WEANLING RAT.

1. Male weanling rats were given for extended periods diets containing gum arabic or wheat offal or various offal fractions. The fractions included two lipid fractions, a water-soluble extract and a modified-acid-detergent (MAD)-fibre extract. The diets contained either low concentrations of aflatoxin B1 (induced rats) or were free from this source of aflatoxin (non-induced rats). The distribution of 14C was then studied after the rats received 14C-labelled aflatoxin B1 in their feed. Blood plasma concentrations of triglycerides, and total cholesterol were also measured. 2. Gum arabic and wheat offal accelerated the rate of passage of 14C through the small intestine and wheat offal very considerably decreased retention time in the large intestine. Both fibre sources increased faecal bulk. However, only wheat offal decreased liver and urinary accumulation of 14C and the effect could be explained entirely by the MAD-fibre fraction of wheat offal. 3. The possible induction of either microsomal enzymes unrelated to the production of mutagenic aflatoxin metabolites, or of extramicrosomal enzymes is discussed; but it is concluded that the main effect brought about by wheat offal on the toxicity and carcinogenicity of aflatoxin can be attributed to a direct influence of the MAD fibre fraction of wheat offal on the intestinal absorption of aflatoxin B1. 4. The relevance of these conclusions to drug safety studies is discussed, because comparable studies may yield differing results, 3: The possible induction of either microsomal enzymes unrelated to the production of mutagenic aflatoxin metabolites, or of extramicrosomal enzymes is discussed; but it is concluded that the main effect brought about by wheat offal on the toxicity and carcinogenicity of aflatoxin can be attributed to a direct influence of the MAD fibre fraction of wheat offal on the intestinal absorption of aflatoxin B1. 4. The relevance of these conclusions to drug safety studies is discussed, because comparable studies may yield differing results, despite a use of diets having the same nutrient composition but differing ingredient composition.

3: J Am Coll Nutr 1993 Apr;12(2):147-54 // Jensen CD, Spiller GA, Gates JE, Miller AF, Whittam JH.

THE EFFECT OF ACACIA GUM AND A WATER-SOLUBLE DIETARY FIBER MIXTURE ON BLOOD LIPIDS IN HUMANS.

Shaklee Health Sciences Department, Shaklee US, Inc. San Francisco, CA 94111. Water-soluble dietary fibers (WSDF) are generally thought to lower cholesterol. This study compared the cholesterol-lowering effects of a medium viscosity WSDF mixture (psyllium, pectin, guar gum and locust bean gum) with an equal amount of WSDF from acacia gum, which has a lower viscosity. Hypercholesterolemic males (n = 13) and females (n = 16) were randomly assigned to one of two WSDF treatments provided in a low-calorie powder form for mixing into beverages (< 4 kcal/serving). Subjects were instructed to mix powders into their usual beverages and to consume them three times daily (5 g WSDF/serving) for 4 weeks while consuming their typical fat-modified diets. Exercise and body weights were also held constant. The WSDF mixture yielded a 10% decrease in plasma total cholesterol (from 251 +/- 20 to 225 +/- 19 mg/dL; p < 0.01), and a 14% reduction in low-density lipoprotein cholesterol (from 167 +/- 14 to 144 +/- 14 mg/dL; p < 0.001). No significant changes in plasma high-density lipoprotein cholesterol, very-low-density lipoprotein cholesterol or triglycerides were observed. In contrast, the acacia gum-treated group showed no change in any plasma lipid parameters. The WSDF treatments did not produce significant changes in mean dietary intakes within or between treatment groups. These data support previous findings that a diet rich in select WSDF can be a useful cholesterol-lowering adjunct to a fat-modified diet, but that caution should be exercised in ascribing cholesterol-lowering efficacy to dietary fibers based solely on their WSDF classification. Finally, WSDF viscosity is a potential cholesterol-lowering factor to be explored further.

4: J Pak Med Assoc 1989 Aug;39(8):208-12 // Wadood A, Wadood N, Shah SA.

EFFECTS OF ACACIA ARABICA AND CARALLUMA EDULIS ON BLOOD GLUCOSE LEVELS OF NORMAL AND ALLOXAN DIABETIC RABBITS.

The powdered seeds of *Acacia arabica* and roots of *Caralluma edulis* were administered in doses of 2, 3 and 4 gm/kg body-weight to normal and alloxan-diabetic rabbits. The blood glucose levels were estimated before and 2, 4, 6 and 8 hours after the administration of plant suspension. The powdered seeds of *Acacia arabica* exerted a significant (P less than 0.05) hypoglycemic effect in normal rabbits. The hypoglycemic effect was not significant (P greater than 0.01) in alloxan diabetic rabbits. The powdered roots of *Caralluma edulis* did not produce any significant (P greater than 0.01) hypoglycaemic effect in normal as well as in alloxan diabetic rabbits. The doses used did not show any acute toxicity and behavioural changes. From this study it may be concluded that the powdered seeds of *Acacia arabica* act by initiating the release of insulin from pancreatic beta cells of normal rabbits. Moreover, *Caralluma edulis* did not show any hypoglycaemic effect in normal as well as in diabetic rabbits.

5: Br J Nutr 1984 Jan;51(1):47-56 // McLean Ross AH, Eastwood MA, Brydon WG, Busuttill A, McKay LF. A STUDY OF THE EFFECTS OF DIETARY GUM ARABIC IN THE RAT.

Gum arabic (GA) is a water-soluble polysaccharide (molecular weight approximately 850 000) containing rhamnose, arabinose, glucuronic acid and galactose. The metabolism of GA has been studied in the rat. Adult male Wistar rats were given GA incorporated into either an Oxoid breeders (OB) diet or an elemental (Elem) diet. Intestinal contents were examined for precipitable GA using acidified ethanol. GA was found from stomach to small intestine but not in the caecum, colon or rectum. Excreted methane, hydrogen and volatile fatty acids (VFA) were measured as indicators of bacterial activity in the caecum and colon. Methane excretion increased on the OB + GA diet and H₂ concentrations remained unaltered. When the animals were given the Elem + GA diet, H₂ and methane were only produced after 28 d. Faecal VFA increased with increasing GA intake, acetate concentration increased and butyrate concentration decreased with increasing GA dosage. Significant decreases in concentrations of VFA were found from caecum to left colon and from left colon to faeces. It can be concluded that GA degradation occurs in the caecum and is associated with increased methane excretion, increased VFA concentrations and changes in the proportions of various VFA in the faeces.

6: Am J Cardiol 1992 Feb 15;69(5):433-9 // Haskell WL, Spiller GA, Jensen CD, Ellis BK, Gates JE. - Stanford Center for Research in Disease Prevention, Palo Alto, California, USA.

ROLE OF WATER-SOLUBLE DIETARY FIBER IN THE MANAGEMENT OF ELEVATED PLASMA CHOLESTEROL IN HEALTHY SUBJECTS.

Guidelines for the use of water-soluble dietary fibers (WSDF) in the dietary management of elevated plasma cholesterol are not well-established. Consequently, 4 studies were conducted to explore the plasma lipid-lowering effects of a variety of WSDF. Studies were randomized, double-blind, placebo-controlled trials involving healthy men and women (plasma cholesterol greater than 5.17 mmol/liter; greater than 200 mg/dl). Study duration ranged from 4 to 12 weeks. The WSDF acacia gum yields a low viscosity, palatable beverage when mixed in water. However, despite its WSDF classification, acacia gum consumed for 4 weeks as the sole WSDF source (15 g of WSDF/day) or primary source in a WSDF mixture (17.2 g of WSDF/day; 56% derived from acacia gum) did not produce a significant lipid-lowering effect versus placebo. When 15 g of WSDF/day consisting of psyllium husk, pectin, and guar and locust bean gums (medium viscosity) was consumed for 4 weeks, significant reductions in cholesterol resulted (total cholesterol 8.3%, low-density lipoprotein cholesterol 12.4%; p less than 0.001) that were comparable to changes achieved with 10 g of WSDF/day from high-viscosity guar gum. The magnitude of the lipid-lowering effect was related to intake of WSDF ranging from 5 to 15 g/day (low-density lipoprotein cholesterol +0.8% [placebo], -5.6% [5 g/day], -6.8% [10 g/day], -14.9% [15 g/day]; p less than 0.01 for trend). The effects of WSDF on plasma lipids were similar for men and women. A diet rich in selected WSDF may be a useful adjunct to the dietary management of elevated plasma cholesterol.

7: Am J Clin Nutr 1990 Jul;52(1):128-34 // Adiotomre J, Eastwood MA, Edwards CA, Brydon WG. Gastro-Intestinal Unit, Western General Hospital, Edinburgh, Scotland.

DIETARY FIBER (DF): INVITRO METHODS ANTICIPATING NUTRITION & METABOLIC ACTIVITY IN HUMANS.

This study describes simple methods based on dialysis and fermentation that enable a hierarchy of fibers to be described for each of the major actions of fiber along the gastro-intestinal tract: nutrient absorption, sterol metabolism, cecal fermentation, and fecal bulking. DF that modifies nutrient absorption can be identified by using dialysis studies, whereas identifying DF that modifies sterol metabolism, cecal fermentation, and fecal weight requires formulas that incorporate dialysis and fermentation results. Results from dialysis and fermentation predicted the action of wheat bran, pectin, guar, gum arabic, carboxymethylcellulose, gellan, tragacanth, xanthan, and karaya in humans and generated anomalous results for karaya and tragacanth. These methods could form the basis of techniques that would enable a screening of novel and processed fibers before studies in animals, including humans.

8: Drug Dev Ind Pharm 2000 Oct;26(10):1025-38 // Bhardwaj TR, Kanwar M, Lal R, Gupta A. - University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh, India.

NATURAL GUMS AND MODIFIED NATURAL GUMS AS SUSTAINED-RELEASE CARRIERS.

Although natural gums and their derivatives are used widely in pharmaceutical dosage forms, their use as biodegradable polymeric materials to deliver bioactive agents has been hampered by the synthetic materials. These natural polysaccharides do hold advantages over the synthetic polymers, generally because they are nontoxic, less expensive, and freely available. Natural gums can also be modified to have tailor-made materials for drug delivery systems and thus can compete with the synthetic biodegradable excipients available in the market. In this review, recent developments in the area of natural gums and their derivatives as carriers in the sustained release of drugs are explored.

9: J Agric Food Chem 2001 Jul;49(7):3385-8 // McNamee BF, O'Riordan ED, O'Sullivan M. Department of Food Science, Faculty of Agriculture, University Belfield, Dublin, Ireland.

EFFECT OF PARTIAL REPLACEMENT OF GUM ARABIC WITH CARBOHYDRATES ON ITS MICROENCAPSULATION PROPERTIES.

Gum arabic solutions (10% w/v) were emulsified with soy oil at oil/gum ratios of 0.25-5.0. At oil/gum ratios <1.0, it was established that gum arabic could be partially replaced with a nonsurfactant carbohydrate. To assess different carbohydrates as replacers for gum arabic, emulsions and spray-dried emulsions of soy oil and mixed solutions (10% w/v) of gum arabic and a range of carbohydrate wall materials (oil/gum = 0.5) were prepared and analyzed. Maize starch and glucose were ineffective as partial replacers of gum arabic, but maltodextrins of various dextrose equivalence values (5.5-38) successfully replaced 50% of the gum arabic. The microencapsulation efficiency of the gum arabic/maltodextrin stabilized powders was further increased by increasing total solids of the feed to the dryer and by increasing the atomizer nozzle diameter.

10: J Nutr 1995 Feb;125(2):283-92 // Annison G, Trimble RP, Topping DL. - CSIRO Division of Human Nutrition, Australia.

FEEDING AUSTRALIAN ACACIA GUMS AND GUM ARABIC LEAD TO NON-STARCH POLYSACCHARIDE ACCUMULATION IN THE CECUM OF RATS.

Exudative gums from two Australian Acacia species (*A. pycnantha* and *A. baileyana*) and gum arabic (from *A. senegal*) were fed to rats at graded levels (0, 20, 40, 80 g/kg), replacing cellulose in purified diets containing cholesterol plus cholic acid. Compared with consumption of the control diet containing cellulose only, consumption of the gums had no significant effects on concentrations of plasma or liver cholesterol. Plasma triacylglycerol concentrations were higher in rats fed gum arabic, whereas liver triacylglycerols were lower in rats fed the gums. The gums did not affect the total pool of volatile fatty acids in the ceca, as compared with results in controls, but did promote the relative contribution of propionate at the expense of acetate. In rats fed the diet containing cellulose (80 g/kg) the proportions of cecal acetate:propionate:butyrate were 76:15:9, whereas in the rats fed *A. pycnantha* gum, gum arabic and *A. baileyana* gum (80 g/kg) the ratios were 42:54:4, 35:46:19 and 43:53:4, respectively. The low apparent fermentability of the gums was confirmed by the accumulation of non-starch polysaccharides in cecal digesta. In rats fed 80 g/kg *A. pycnantha* gum, 3.44 g of soluble non-starch polysaccharides was measured in the ceca, which was 58% of the dry weight of the cecal contents. We conclude that the biological activities of the Australian Acacia gums were similar to those of gum arabic and that these gums may have potential value as human food ingredients.

11: Br J Nutr 1986 Mar;55(2):261-6 // Wyatt GM, Bayliss CE, Holcroft JD. - Agricultural and Food Research Council, Food Research Institute Norwich.

A CHANGE IN HUMAN FAECAL FLORA IN RESPONSE TO INCLUSION OF GUM ARABIC IN THE DIET.

1. Gum arabic is a water-soluble polysaccharide resistant to human gut enzymes and thus can be described as dietary fibre. 2. Using a most-probable-number technique, estimates were made of total anaerobes and of gum-arabic fermenters in the faeces of a volunteer during a control period and during addition of 10 g gum arabic/d to the diet. Using an enrichment technique, the principal bacteria able to utilize gum arabic as the only carbohydrate source were isolated and characterized. 3. Faecal samples were analysed for undegraded gum arabic and, following acid-hydrolysis, for total sugars. 4. The proportion of the faecal flora able to degrade the gum arabic polymer rose from an initial level of 6.5% to more than 50% during gum-arabic ingestion, and subsequently returned to the control level after ingestion ceased. The principal gum-arabic fermenters were species of *Bacteroides* and *Bifidobacterium*. 5. Undegraded gum arabic was not detected in any faecal sample nor were there significant differences in the level of total sugars in acid-hydrolysed faeces between gum arabic and control periods. 6. The results presented indicate a direct and rapid change in faecal flora in response to a specific change in the diet of a human volunteer.

12: Phytochemistry 2000 May;54(1):99-106 // Goodrum LJ, Patel A, Leykam JF, Kieliszewski MJ. - Ohio State University School of Ophthalmology, Columbus, USA.

GUM ARABIC GLYCOPROTEIN CONTAINS GLYCOMODULES OF BOTH EXTENSIN AND ARABINO-GALACTAN-GLYCOPROTEINS.

Gum arabic glycoprotein (GAGP) is a large molecular weight, hydroxyproline-rich arabinogalactan-protein (AGP) component of gum arabic. GAGP has a simple, highly biased amino acid composition indicating a repetitive polypeptide backbone. Previous work, suggested small (approximately 11 residue) repetitive peptide motifs each with three Hyp-arabinoside attachment sites and a single Hyp-arabinogalactan polysaccharide attachment site. We tested that hypothesis by sequence analysis of the GAGP polypeptide after HF-deglycosylation. A family of closely related peptides confirmed the presence of a repetitive 19-residue consensus motif. However, the motif: Ser-Hyp-Hyp-Hyp-Thr-Leu-Ser-Hyp-Ser-Hyp-Thr-Hyp-Thr-Hyp-Hyp-Leu-Gly-Pro-His, was about twice the size anticipated. Thus, judging by Hyp-glycoside profiles of GAGP, the consensus motif contained six Hyp-arabinosides rather than three and two Hyp-polysaccharides rather than one. We inferred the glycosylation sites based on the Hyp contiguity hypothesis which predicts arabinosides on contiguous Hyp residues and arabinogalactan polysaccharides on clustered non-contiguous Hyp residues, i.e. the GAGP motif would consist of arabinosylated contiguous Hyp blocks flanking two central Hyp-polysaccharides. We predict this rigidifies the glycoprotein, enhances the overall symmetry of the glycopeptide motif, and may explain some of the remarkable properties of gum arabic.

13: Acta Cient Venez 1992;43(5):312-4 // Melito C, Levy-Benshimol A. - Universidad Central de Venezuela, Centro de Biología Celular, Caracas, Venezuela.

VEGETABLE GUMS MODIFY LECTIN HEMAGGLUTINABILITY.

Arabic gum enhances lectin hemagglutinability. The more glycosylated the lectin, the greater the stimulatory effect of the gum. Evidence presented suggests that the interaction between gum and lectin is of a carbohydrate-carbohydrate nature.

14: Food Chem Toxicol 1983 Jun;21(3):305-11 // Melnick RL, Huff J, Haseman JK, Dieter MP, Grieshaber CK, Wyand DS, Russfield AB, Murthy AS, Fleischman RW, Lilja HS.

CHRONIC EFFECTS OF AGAR, GUAR GUM, GUM ARABIC, LOCUST-BEAN GUM, ORTARA GUM IN F344 RATS AND B6C3F1 MICE.

Diets containing 25,000 (2.5%) or 50,000 ppm (5.0%) agar, guar gum, gum arabic, locust-bean gum or tara gum were fed to groups of 50 male and 50 female F344 rats and B6C3F1 mice for 103 wk. Separate groups of 50 rats and 50 mice of each sex served as controls for each study. There were no significant differences in survival between any of the dosed groups of rats or mice and their respective control groups. Depressions in body-weight gain greater than 10% for dosed groups relative to their respective control groups were observed for male (low dose only) and female mice fed diets containing agar, female mice fed diets containing guar gum (high dose only), male mice fed diets containing locust-bean gum (high dose only) and male and female mice fed diets containing tara gum (high dose only). Depressions in body-weight gain greater than 5% were observed for female rats fed diets containing agar, guar gum or gum arabic. There were no histopathological effects associated with the administration of the test materials. Under the conditions of these bioassays, none of the five polysaccharides was carcinogenic for F344 rats or B6C3F1 mice of either sex.

15: J Nutr 1995 Oct;125(10):2604-9 // Howard MD, Gordon DT, Garleb KA, Kerley MS. - Department of Animal Science, University of Missouri, Columbia, USA.

VARIABLE EFFECTS OF DIETARY FRUCTOOLIGOSACCHARIDE, XYLOOLIGOSACCHARIDE AND GUM ARABIC ON CECAL AND COLONIC MICROBIOTA AND EPITHELIAL CELL PROLIFERATION IN MICE AND RATS.

Two experiments were conducted to determine if supplementing soluble fiber (fructooligosaccharide, xylooligosaccharide or gum arabic) to a semi-elemental diet would beneficially change cecal and colonic microbiota populations and enhance epithelial cell proliferation. Experiments 1 and 2 used identical dietary regimens; mice and rats were given free access to a powdered semi-elemental diet. Animals were assigned to one of the four following treatment groups: control, no supplemental dietary fiber, fructooligosaccharide, xylooligosaccharide and gum arabic. In Experiment 1 populations of Bifidobacteria and total anaerobic flora were enumerated from the contents of the cecum and colon of weanling mice. Consumption of fructooligosaccharide increased ($P < 0.05$) the concentrations of Bifidobacteria and the ratio of Bifidobacteria to total anaerobic flora. In Experiment 2 tissue from the cecum and distal colon of weanling rats was examined for morphological changes of the mucosa. Consumption of xylooligosaccharide increased ($P < 0.05$) cecal crypt depth and labeling index relative to the other three treatments. Consumption of gum arabic and the control diet increased ($P < 0.01$) cecal proliferation zone. Consumption of xylooligosaccharide and the control diet increased ($P < 0.01$) cecal cell density (number of cells in a vertical-half of the crypt). Distal colonic crypt depth was greatest ($P < 0.05$) in controls and rats fed fructooligosaccharide, intermediate in those fed gum arabic, and smallest in those fed xylooligosaccharide. These results suggest that fructooligosaccharide effectively stimulates growth of Bifidobacteria and xylooligosaccharide supports a modest enhancement of cecal epithelial cell proliferation.

16: Am J Clin Nutr 1996 Mar;63(3):392-8 // Bliss DZ, Stein TP, Schleifer CR, Settle RG. University of Pennsylvania School of Nursing, Philadelphia, USA.

SUPPLEMENTATION WITH GUM ARABIC FIBER INCREASES FECAL NITROGEN EXCRETION AND LOWERS SERUM UREA NITROGEN CONCENTRATION IN CHRONIC RENAL FAILURE PATIENTS CONSUMING A LOW-PROTEIN DIET.

In chronic renal failure (CRF), plasma concentrations of the products of protein metabolism are increased. Current dietary management is to prescribe a decrease in protein intake. The use of dietary fiber to increase fecal excretion of retained metabolites in CRF may be a beneficial adjunct to a low-protein diet (LPD). Colonic bacteria ferment dietary fiber, providing them with energy for growth and nitrogen incorporation, in turn, increasing nitrogen excretion in feces. Sixteen CRF patients consuming an LPD were randomly assigned to receive a supplement of a highly fermentable fiber, gum arabic (50 g/d), or a placebo (1 g pectin/d) in a prospective, single-blind, crossover design. Fecal bacterial mass and fecal nitrogen content were significantly increased during supplementation with gum arabic compared with the baseline LPD or supplementation with pectin. Serum urea nitrogen was significantly decreased during supplementation with gum arabic compared with the baseline LPD or supplementation with pectin. Nitrogen balance did not change significantly.

17: Nutr Cancer 1993;19(1):43-54 // Harris PJ, Robertson AM, Watson ME, Triggs CM, Ferguson LR. - Department of Botany, University of Auckland, New Zealand.

THE EFFECTS OF SOLUBLE-FIBER POLYSACCHARIDES ON THE ADSORPTION OF A HYDROPHOBIC CARCINOGEN TO AN INSOLUBLE DIETARY FIBER.

Dietary fiber is believed to decrease the incidence of colorectal cancer. Dietary fibers may be divided broadly into insoluble and soluble fibers. Adsorption of carcinogens to insoluble dietary fiber in the intestinal tract is one of the mechanisms by which dietary fiber is believed to protect against colorectal cancer. In previous in vitro experiments, we showed that the hydrophobic carcinogen 1,8-dinitropyrene (DNP) adsorbs to insoluble plant cell wall components (insoluble dietary fibers). Soluble polysaccharides (pectic polysaccharides) extracted from the walls of parenchyma cells of dicotyledonous plants were found to maintain DNP in aqueous solutions and decrease its adsorption to insoluble wall components. In the present study, we examined a commercial preparation of pectin and seven other soluble-fiber polysaccharides with diverse structures for their effects on the distribution of DNP. Many of these are used as emulsifiers and stabilizers in the food industry. They all maintained DNP in aqueous solution and decreased its adsorption to alpha-cellulose, which we used as an example of an insoluble dietary fiber. Gum arabic was the most effective and kappa-carrageenan the least. The capacity of the polysaccharides to act as emulsifiers and stabilizers may explain their effects on DNP distribution. The monosaccharide glucose and the disaccharide cellobiose had no effect on the distribution of DNP. These results indicate three possible mechanisms by which soluble-fiber polysaccharides may enhance the development of colorectal cancer. First, because they reduce the ability of insoluble dietary fibers to adsorb hydrophobic carcinogens, more carcinogens may enter the colon maintained in solution than adsorbed onto insoluble fibers. Second, if soluble-fiber polysaccharides are maintaining hydrophobic carcinogens in solution and these polysaccharides are degraded by bacterial enzymes in the colon, then the carcinogens may come out of solution and be deposited onto the mucosal surface of the colon. Third, soluble-fiber polysaccharides may cross the intestinal epithelium and carry with them carcinogens maintained in solution. These studies have important consequences for nutrition, because soluble-fiber polysaccharides represent a common component of foods.

18: J Pediatr Gastroenterol Nutr 1999 Oct;29(4):411-7 // Teichberg S, Wingertzahn MA, Moyses J, Wapnir RA. - Department of Pediatrics, North Shore University Hospital, NY University School of Medicine, Manhasset, USA.

EFFECT OF GUM ARABIC IN AN ORAL REHYDRATION SOLUTION ON RECOVERY FROM DIARRHEA IN RATS.

BACKGROUND: It has been shown that gum arabic, a soluble fiber, enhances water, electrolyte, and glucose absorption from oral rehydration solutions in jejunal perfusion of healthy rats and in animals with theophylline-induced secretion or chronic osmotic-secretory diarrhea. This report concerns a study of the effectiveness of an oral rehydration solution supplemented with gum arabic, during recovery from chronic osmotic secretory diarrhea in free-living rats. **METHODS:** Chronic diarrhea was induced in 60- to 80-g juvenile rats by providing a magnesium citrate-phenolphthalein solution as the sole fluid source for 7 days. This led to diarrhea characterized by dehydration, soft stools, increased cecal volume, decreased food and fluid intake and failure to gain weight. After 7 days of diarrhea, rats recovered for 24 hours with either tap water or an oral rehydration solution (90 mM Na, 111 mM glucose, 20 mM K, 80 mM chloride, 20 mM citrate) with or without 2.5 g/l gum arabic. **RESULTS:** Although all three solutions improved the diarrhea, optimal recovery from diarrhea was achieved with the gum arabic-supplemented oral rehydration solution. After 4 hours and 24 hours, rats drinking the gum arabic-supplemented solution gained more weight and had lower fecal output than rats receiving water or the rehydration solution without gum arabic. **CONCLUSIONS:** The positive effects of the gum arabic-supplemented rehydration solution on fluid and electrolyte absorption seen during jejunal perfusion also occurred during recovery from chronic osmotic secretory diarrhea, when free-living animals drank the solution ad libitum.

19: Food Addit Contam 1987 Jul-Sep;4(3):233-46 // Fournier PE, Fournier-Desvaux M, Crouzette J, Palombo S, Vicaut E. - Unite de Pharmacologie Clinique, Hopital Fernand Widal, Paris, France.

DETERMINATION OF THE CALORIC VALUE OF GUM ARABIC IN THE MALE RAT.

Sprague-Dawley male rats were given normal diets (UARA 03) containing various amounts of gum arabic, sucrose and lignin for eight consecutive weeks. While the data obtained from sucrose diets showed that these diets caused a clear incremental effect on energy production with respect to both test animals and controls, and data from lignin diets were found to produce a negative effect on energy yields, gum arabic diets produced results indicating that at certain levels of intake, gum arabic may contribute energy values slightly superior to those of lignin (0 cal-g), possibly between zero and 1 cal/g.

20: Nutrition 1994 Nov-Dec;10(6):544-50 // Assimon SA, Stein TP. - Department of Surgery, University of Medicine and Dentistry of New Jersey, School of Osteopathic Medicine, Stratford USA.

DIGESTIBLE FIBER (GUM ARABIC), NITROGEN EXCRETION AND UREA RECYCLING IN RATS.

The effect of dietary fiber and level of amino acid (AA) intake on 1) partitioning of N excretion between urine and feces, 2) level of dietary AA on urea N kinetics, and 3) reutilization of urea-originated N into essential AAs was determined. In the first experiment, rats were adapted to one of two isocaloric (928-mJ.kg-1.day-1) and isonitrogenous (1.33-g N.kg-1.day-1) liquid diets containing 0 or 9% of nonprotein energy as gum arabic (GA) for 7 days. The rats were further subdivided, with half from each group continuing their diet and the AA intake of the remainder reduced by half (0.67 g N.kg-1.day-1). Daily N balance was determined over the next 5 days. For experiment 2, a catheter was inserted into the rats used for experiment 1, and 5-6 days later, urea production and urea N recycling were determined with [15N2]urea. In experiment 3, as in experiment 1, rats were adapted to the reduced AA diet with and without GA and then given [15N2]urea. Plasma lysine was then analyzed for 15N to determine whether AA synthesis by intestinal bacteria was a contributing source of AAs to the body and whether this process was increased with dietary fiber. Dietary fiber decreased urinary N excretion and increased fecal N excretion but had no net effect on N balance. On the adequate-AA diet, GA decreased urea production (523 +/- 36 vs. 374 +/- 47 mg N.rat-1.day-1, p < 0.01), and urea N recycling (47 +/- 4 vs. 30 +/- 6 mg N.rat-1.day-1, p < 0.01) was found.

21: Gastroenterology 1997 Jun;112(6):1979-85 // Wapnir RA, Wingertzahn MA, Moyses J, Teichberg S. - Department of Pediatrics, North Shore Univ. Hospital-NY University School of Medicine, Manhasset, USA.

GUM ARABIC PROMOTES RAT JEJUNAL SODIUM AND WATER ABSORPTION FROM ORAL REHYDRATION SOLUTIONS IN TWO MODELS OF DIARRHEA.

BACKGROUND & AIMS: We have shown that addition of gum arabic (GA) to a 90 mmol/L sodium-111 mmol/L glucose oral rehydration solution (ORS) enhances its effectiveness for water and electrolyte absorption in normal rats. The present study extends these observations on GA in ORS to two rat models of diarrheal disease. **METHODS:** Juvenile rats were either treated for 1 week with magnesium citrate-phenolphthalein to produce chronic osmotic-secretory diarrhea or lumenally exposed to 10 mmol/L theophylline to induce jejunal secretion. In both models jejunal perfusion was used to assess absorption. **RESULTS:** Addition of 2.5 or 5.0 g/L GA to ORS increased roughly twofold absorption of sodium, potassium, and water in the model of chronic osmotic-secretory diarrhea. Rats perfused with GA-supplemented ORS showed an expansion of the basolateral intercellular spaces between villus absorptive epithelial cells and the lamina propria, reflecting enhanced water and sodium absorption. Similarly, addition of 2.5, 5.0, or 10.0 g/L GA to the ORS neutralized theophylline-induced abolition of net sodium and potassium absorption and reversed water and glucose malabsorption. **CONCLUSIONS:** These experimental studies in models of diarrhea suggest that GA may be a useful additive to ORS for the potentiation of water and electrolyte absorption.

22: Am J Clin Nutr 1991 Jun;53(6):1418-24 // Titgemeyer EC, Bourquin LD, Fahey GC Jr, Garleb KA. - Division of Nutritional Sciences, University of Illinois, Urbana USA.

FERMENTABILITY OF VARIOUS FIBER SOURCES BY HUMAN FECAL BACTERIA INVITRO.

Certain beneficial effects of fiber in the human diet may be mediated by short-chain fatty acids (SCFAs) produced during anaerobic fermentation in the colon. Two studies, both involving in vitro incubations with human fecal bacteria as inoculum, were conducted to assess fermentation of various fiber sources and to quantitate the SCFAs produced. In experiment 1, substrate fermentability based on total SCFA production ranked as follows: citrus pectin greater than soy fiber greater than sugarbeet fiber greater than pea fiber greater than oat fiber. Fermentation of soy fiber led to higher proportions of propionate and butyrate than did fermentation of other substrates. In experiment 2, fermentation of gum arabic, a mixture of arabic and guar, and apple pectin resulted in greater SCFA production than did fermentation of either oat fiber or corn bran. Fermentation of gums led to more propionate and butyrate production than did that of apple pectin. It may be possible to select fiber sources capable of supporting stipulated amounts of both total and individual SCFA production in the human colon.

23: Food Addit Contam 1989 Jan-Mar;6(1):13-20 // Harley LJ, Davies IR, Livesey G. - Institute of Food Research, Norwich Laboratory, U.K.

DIGESTIBLE ENERGY VALUE OF GUMS IN THE RAT - DATA ON GUM ARABIC.

Male Wistar rats were fed a defined formula diet free from non-starch polysaccharides and either containing no additive or supplemented with gum arabic or cellulose or starch. Food and faeces were analysed by bomb calorimetry both to assess the effect of these substances on the apparent digestibility of dietary gross energy and to ascribe digestible energy values to the supplements. The former was not affected by starch and was decreased more by cellulose than by gum arabic. The energy values obtained were 17.4 +/- 0.4 kJ/g starch, 1.7 +/- 0.6 kJ/g cellulose and 14.7 +/- 0.5 kJ/g gum arabic. The latter is consistent with the high apparent digestibility of gum arabic in vivo and casts doubt on the validity of growth assay procedures that suggest a near-zero energy value for gum arabic.

24: Nurs Res 2001 Jul-Aug;50(4):203-13 // Bliss DZ, Jung HJ, Savik K, Lowry A, LeMoine M, Jensen L, Werner C, Schaffer K. - School of Nursing, University of Minnesota, Minneapolis, USA.

SUPPLEMENTATION WITH DIETARY FIBER IMPROVES FECAL INCONTINENCE.

BACKGROUND: Human studies have shown that dietary fiber affects stool composition and consistency. Because fecal incontinence has been shown to be exacerbated by liquid stools or diarrhea, management strategies that make stool consistency less loose or liquid may be useful. **OBJECTIVE:** To compare the effects of a fiber supplement containing psyllium, gum arabic, or a placebo in community-living adults who were incontinent of loose or liquid stools. Mechanisms underlying these effects (e.g., fermentation of the fibers and water-holding capacity of stools) were examined. **METHODS:** Thirty-nine persons with fecal incontinence of loose or liquid stools prospectively recorded diet intake and stool characteristics and collected their stools for 8 days prior to and at the end of a 31-day fiber supplementation period. During the fiber supplementation period, they ingested psyllium, gum arabic, or a placebo by random assignment. **RESULTS:** In the baseline period, the groups were comparable on all variables measured. In the fiber supplementation period, (a) the proportion of incontinent stools of the groups ingesting the fiber supplements was less than half that of the group ingesting the placebo, (b) the placebo group had the greatest percentage of stools that were loose/unformed or liquid, and (c) the psyllium group had the highest water-holding capacity of water-insoluble solids and total water-holding capacity. The supplements of dietary fiber appeared to be completely fermented by the subjects as indicated by nonsignificant differences in total fiber, short chain fatty acids and pH in stools among the groups in the baseline or fiber supplementation periods. **CONCLUSIONS:** Supplementation with dietary fiber from psyllium or gum arabic was associated with a decrease in the percentage of incontinent stools and an improvement of stool consistency. Improvements in fecal incontinence or stool consistency did not appear to be related to unfermented dietary fiber.

25: Scand J Gastroenterol 1994 Oct;29(10):916-22 // May T, Mackie RI, Fahey GC Jr, Cremin JC, Garleb KA. - Dept. of Animal Sciences, University of Illinois, Urbana, USA.

EFFECT OF FIBER SOURCE ON SHORT-CHAIN FATTY ACID PRODUCTION AND ON THE GROWTH AND TOXIN PRODUCTION BY CLOSTRIDIUM DIFFICILE.

BACKGROUND: Fermentable fiber promotes the growth of resident gut microbes, which modify the environment of the gastrointestinal tract and thus prevent colonization by *Clostridium difficile*. **METHODS:** An in vitro system with pigs as fecal inoculum donors was used to estimate fiber fermentability and changes in intestinal microbiota. **RESULTS:** Acetate and propionate production (mmol/mg substrate fermented/day) was greatest for gum arabic (1013.4 and 704.1, respectively); butyrate production was greatest for xylo-oligosaccharide (345.6). Growth of total anaerobes and clostridia was greatest for gum arabic (21.2 and 16.2 x 10⁸ counts/ml, respectively) and xylo-oligosaccharides (21.0 and 19.6 x 10⁸ respectively). No culturable counts of *C. difficile* were obtained, nor was toxin A detected. **CONCLUSIONS:** Fermentable fibers support the growth of indigenous intestinal bacteria, particularly acidogenic bacteria, and yield large amounts of short-chain fatty acids with decreased gut pH. These factors contribute to the prevention of growth and toxin elaboration.

26: Food Chem Toxicol 1987 Nov;25(11):815-21 // Collins TF, Welsh JJ, Black TN, Graham SL, Brown LH. - Center for Food Safety and Applied Nutrition, FDA, Washington, DC, USA.

STUDY OF THE TERATOGENIC POTENTIAL OF GUM ARABIC.

Gum arabic in the diet at 0, 1, 2, 4, 7.5 or 15% was available ad lib. to male and female Osborne-Mendel rats during pre-mating and mating and throughout gestation. During gestation, the treated females consumed from 683 mg gum/kg body weight/day in the 1% group to 10,647 mg gum/kg/day in the 15% group. The animals were killed on gestation day 20. There were no dose-related changes in maternal findings, number of foetuses, foetal viability or external, visceral or skeletal variations. No terata were seen.

27: J Clin Periodontol 1993 Apr;20(4):238-43 // Clark DT, Gazi MI, Cox SW, Eley BM, Tinsley GF.- Department of Microbiology, King's College School of Medicine and Dentistry, London, UK.

THE EFFECTS OF ACACIA ARABICA GUM ON THE INVITRO GROWTH AND PROTEASE ACTIVITIES OF PERIODONTOPATHIC BACTERIA.

The antibacterial activity of acacia gum was assessed using fresh isolates and reference strains of *Actinobacillus actinomycetemcomitans*, *Capnocytophaga* spp., *Porphyromonas gingivalis*, *Prevotella intermedia* and *Treponema denticola*. A fine aqueous suspension of gum was produced by sonication and then a soluble fraction isolated by centrifugation and membrane filtration. These preparations were incorporated into columbia agar at doubling concentrations. Growth of *P. gingivalis* and *P. intermedia* cultures on the agar was inhibited by whole gum sonicate at concentrations of 0.5-1.0% w/v. Both species showed reduced susceptibility when horse blood was present in the agar. The gum soluble fraction did not inhibit growth of any bacterial culture. Enzyme activities were determined by fluorimetric assay with various synthetic peptide substrates. Most protease activities reduced in the presence of 0.5% w/v gum sonicate, with the trypsin-like activities of *P. gingivalis* and *P. intermedia* proving most sensitive. The gum soluble fraction was nearly always less inhibitory than the sonicate. The action of acacia gum against suspected periodontal pathogens and their enzymes suggests that it may be of clinical value.

28: Chem Biol Interact 1995 Apr 14;95(3):245-55 // Ferguson LR, Robertson AM, Watson ME, Triggs CM, Harris PJ. Cancer Research Laboratory, University of Auckland, New Zealand.

THE EFFECTS OF A SOLUBLE-FIBRE POLYSACCHARIDE ON THE ADSORPTION OF CARCINOGENS TO INSOLUBLE DIETARY FIBRES.

Epidemiology and animal experiments indicate that dietary fibres protect against the development of colorectal cancer. We found previously that the ability of a carcinogen to adsorb in vitro to alpha-cellulose was strongly related to the hydrophobicity of the carcinogen. Furthermore, soluble dietary fibres (soluble-fibre polysaccharides), including gum arabic, reduced the adsorption of the hydrophobic carcinogen, DNP, to alpha-cellulose. In the present study we tested the ability of gum arabic to reduce the adsorption in vitro of the carcinogens BaP (C log P = 6.124), DNP (C log P = 4.384), and the heterocyclic amines, Trp-P-1 (C log P = 3.230) and MeIQx (C log P = 1.078). Gum arabic reduced the adsorption to alpha-cellulose of BaP and DNP. Gum arabic also reduced the adsorption of BaP to an insoluble, dietary-fibre preparation from commercial cork which contains the hydrophobic component, suberin. The results are discussed in terms of hydrophobic interactions between carcinogens and insoluble dietary fibres. In vivo, it is likely that soluble dietary fibres reduce the adsorption of only highly hydrophobic carcinogens to some insoluble dietary fibres.