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Safety and efficacy of a feed additive consisting of guar gum for all animal species (A.I.P.G. Association for International Promotion of Gums)

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Abstract

Following a request from the European Commission, EFSA was asked to deliver a scientific opinion on the safety and efficacy of guar gum as a feed additive for all animal species. Owing the absence of information, the genotoxic potential of the additive could not be fully assessed. From the results of tolerance studies, the FEEDAP Panel concluded that guar gum is safe for salmonids at a maximum concentration of 3,000 mg/kg complete feed. Guar gum is safe up to ~ 280 mg/kg complete feed for chickens for fattening, 375 mg/kg complete feed for turkeys for fattening, 400 mg/kg complete feed for rabbits, 500 and 600 mg/kg complete feed for piglets and pigs for fattening, respectively, 1,100 mg/kg complete feed for cattle for fattening and 1,150 mg/kg complete feed for veal calves. No conclusions can be reached on the safety for long living and reproductive animals, until the genotoxic potential of the additive is fully assessed in the framework of its use as a feed additive. The use of the additive in animal nutrition is considered safe for the consumer and the environment. In the absence of data, no conclusions could be drawn on the safety of the additive for the user. Guar gum is efficacious as a gelling agent, thickener, and contributes to stabilise canned pet feed. No conclusion can be drawn on the additive as an emulsifier.

Keywords: technological additive, emulsifiers, gelling agents, stabilisers, thickeners, guar gum, safety, efficacy

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1. Introduction

1.1. Background and Terms of Reference

Regulation (EC) No 1831/2003[1] establishes the rules governing the Community authorisation of additives for use in animal nutrition. In particular, Article 10(2) of that Regulation also specifies that for existing products within the meaning of Article 10(1), an application shall be submitted in accordance with Article 7, at the latest one year before the expiry date of the authorisation given pursuant to Directive 70/524/EEC for additives with a limited authorisation period, and within a maximum of seven years after the entry into force of this Regulation for additives authorised without a time limit or pursuant to Directive 82/471/EEC.

The European Commission received a request from A.I.P.G. Association for International Promotion of Gums[2] for re-evaluation of the product guar gum, when used as a feed additive for all animal species (category: technological additives; functional group: emulsifiers, gelling agents, stabilisers, thickeners).

According to Article 7(1) of Regulation (EC) No 1831/2003, the Commission forwarded the application to the European Food Safety Authority (EFSA) as an application under Article 10(2) (re-evaluation of an authorised feed additive). EFSA received directly from the applicant the technical dossier in support of this application. The particulars and documents in support of the application were considered valid by EFSA as of 06 August 2014.

According to Article 8 of Regulation (EC) No 1831/2003, EFSA, after verifying the particulars and documents submitted by the applicant, shall undertake an assessment in order to determine whether the feed additive complies with the conditions laid down in Article 5. EFSA shall deliver an opinion on the safety for the target animals, consumer, user and the environment and on the efficacy of the product guar gum, when used under the proposed conditions of use (see Section 3.1.3).

1.2. Additional information

Guar gum is currently authorised as a feed additive[3] subject to re-evaluation according to Article (10) of Regulation EC 1831/2003. Guar gum is authorised to be used as a food additive in accordance with Annex II to Regulation (EC) No 1333/2008[4] with specific purity criteria defined in Commission Regulation (EU) No 231/2012[5].

Guar gum has not been previously assessed by EFSA as a feed additive. It has been assessed by the Joint FAO/WHO Expert Committee on Food Additives (JECFA, 1970, 1974, 1975) and by the Scientific Committee for Food (SCF, 1978) and considered safe for use in food with an acceptable daily intake (ADI) 'not specified'. The EFSA Panel on Food Additives and Nutrient Sources added to Food (ANS) delivered an opinion on the re-evaluation of guar gum (E 412) as a food additive reaching similar conclusions (EFSA ANS Panel, 2017).

2. Data and methodologies

2.1. Data

The present assessment is based on data submitted by the applicant in the form of a technical dossier[6] in support of the authorisation request for the use of guar gum as a feed additive.

The FEEDAP Panel used the data provided by the applicant together with data from other sources, such as previous risk assessments by EFSA or other expert bodies, peer-reviewed scientific papers, other scientific reports and experts' knowledge, to deliver the present output.

EFSA has verified the European Union Reference Laboratory (EURL) report as it relates to the methods used for the control of the guar gum in animal feed. The Executive Summary of the EURL report can be found in Annex A.[7]

[1] Regulation (EC) No 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition. OJ L 268, 18.10.2003, p. 29.
[2] A.I.P.G. Association for International Promotion of Gums, Sonnistrasse 28, D-20097, Hamburg, Germany.
[3] Commission Directive of 8 July 1985 amending the Annexes to Council Directive 70/524/EEC concerning additives in feedingstuffs, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1985:245:0001:0032:EN:PDF
[4] Regulation (EC) No 1333/2008 of the European Parliament and of the Council of 16 December 2008 on food additives, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:354:0016:0033:en:PDF
[5] Commission Regulation (EU) No 231/2012 of 9 March 2012 laying down specifications for food additives listed in Annexes II and III to Regulation (EC) No 1333/2008 of the European Parliament and of the Council, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012R0231&from=EN
[6] FEED dossier reference: FAD-2010-0391.
[7] The full report is available on the EURL website: https://ec.europa.eu/jrc/sites/jrcsh/files/finrep-fad-2010-0391%20guar%20gum.pdf

2.2. Methodologies

The approach followed by the FEEDAP Panel to assess the safety and the efficacy of guar gum is in line with the principles laid down in Regulation (EC) No 429/2008[8] and the relevant guidance documents: Guidance for the preparation of dossiers for technological additives (EFSA FEEDAP Panel, 2012a), Guidance on studies concerning the safety of use of the additive for users/workers (EFSA FEEDAP Panel, 2012b), Guidance on the identity, characterisation and conditions of use of feed additives (EFSA FEEDAP Panel, 2017a) , Guidance on the assessment of the safety of feed additives for the target species (EFSA FEEDAP Panel, 2017b), Guidance on the assessment of the efficacy of feed additives (EFSA FEEDAP Panel, 2018) and Guidance on the assessment of the safety of feed additives for the environment (EFSA FEEDAP Panel, 2019).

3. Assessment

The additive under assessment, guar gum, is the ground endosperm of the seed of natural strains of the guar plant, *Cyamopsis tetragonoloba L. Taub* (family *Leguminosae*) intended to be used as a technological feed additive (functional groups: emulsifiers, stabilisers, thickeners and gelling agents) in feedingstuffs for all animal species.

3.1. Characterisation

3.1.1. Characterisation of the additive

The additive consists of pure guar gum. Guar gum (Chemical Abstracts Service (CAS) number 9000-30-0, European Inventory of Existing Commercial Chemical Substances (EINECS) number 232-536-0) is a white to yellowish-white, nearly odourless powder. Guar gum is isolated from the seeds of the guar plant (*Cyamopsis tetragonoloba* L. Taub.).[9] The germ and the endosperm halves are separated, then the endosperm halves, called 'guar splits', are further hydrated, bleached, pH adjusted, flaked, ground, dried, sieved, blended and packed.

Guar gum is a polysaccharide and is mainly constituted by galactomannan guaran (not less than 75%). The galactomannan guaran is commonly defined as a high-viscosity water-soluble polysaccharide fraction consisting of linear chains of (1→4)-β-D-mannopyranosyl units with α-D-galactopyranosyl units attached by (1→6) linkages. The molecular weight of the polysaccharide is reported to be approximately 50,000–8,000,000 g/mol (JECFA 2008, Regulation (EU) 231/2012).

The feed additive guar gum is manufactured to meet the specifications set for its use as a food additive. Guar gum is included in Regulation (EC) No 231/2012[5], which lays down the specification for food additive as 'a high molecular weight hydrocolloidal polysaccharide composed of galactopyranose and mannopyranose units combined through glycosidic linkages, which may be described chemically as galactomannan'. The main specifications of the additive are: soluble in cold water, loss on drying 105°C for 5 h (%) ≤ 15, total ash at 800°C ≤ 5.5%, acid-insoluble ash ≤ 7%, protein ≤ 10% (factor N × 6.25), starch not detected, pentachlorophenol ≤ 0.01 mg/kg, organic peroxides ≤ 0.7 meq active oxygen/kg sample and furfural ≤ 1 mg/kg. The analysis of five batches of the additive resulted in galactomannans: 84.1–84.7%; loss on drying: 7.9–8.1%; total ash: 0.7%; acid-insoluble ash: 2.2–2.3%; protein: 4.1–4.6% and pentachlorephenol ≤ 0.01 mg/kg (limit of quantification (LOQ)).[10] Analytical data on organic peroxides and furfural showed compliance with the specifications set for guar gum used as a food additive. No data on the solubility of the additive under assessment was provided.

The analysis of three batches of the additive showed concentrations of lead, mercury, cadmium and arsenic below the respective LOQ.[11] The same three batches showed concentration of aflatoxins (B1, B2, G1 and G2) below the respective LOQ (0.1 μg/kg). Dioxins (including furans) were < 0.06 ng WHO-TEQ/kg in two batches and 0.362 ng WHO-TEQ/kg for one batch. Organochloride pesticides and pyrethroids were < 0.1 mg/kg (LOQ), organophosphorus pesticides were not detected. No contamination with *Salmonella* spp. was found in 25 g of the additive.

The detected amounts of the above impurities do not raise concerns.

[8] Commission Regulation (EC) No 429/2008 of 25 April 2008 on detailed rules for the implementation of Regulation (EC) No 1831/2003 of the European Parliament and of the Council as regards the preparation and the presentation of applications and the assessment and the authorisation of feed additives. OJ L 133, 22.5.2008, p. 1.

[9] Technical dossier/Section II.

[10] Technical dossier/Sin_Aug16/2_Annex_EFSA_Q-2013-01024_FAD-2010-0391_Guar Gum_rev_July2016_fin.

[11] Limit of quantification (LOQ): lead (0.14, 0.3 and < 0.05 mg/kg), mercury < 0.005 mg/kg, cadmium < 0.01 mg/kg and arsenic < 0.1 mg/kg.

The dusting potential (Stauber–Heubach) tested in one batch of the additive (three replicated analysis) showed values of 2.20–2.58 g/m^3.[10] No information on the presence of small particles, including nanoparticles, was provided.

3.1.2. Stability and homogeneity

For technological additives, stability can be demonstrated by persistence of the effect, and no demonstration of homogenous distribution is considered necessary if the efficacy of the additive is demonstrated.

The applicant has provided studies to support the stability of the additive, described below, and the stability/efficacy in feedingstuffs (reported in Section 3.3 Efficacy).

In a study on the shelf-life of the additive, two batches of guar gum were analysed for viscosity in water solution (1%) and moisture, protein content (1 batch) and microbiological purity every three months for up to 18 months in one batch and 24 months in a second batch.[12] No substantial differences were observed at any sampling point.

3.1.3. Conditions of use

The additive is intended to be used as a technological additive (functional groups: emulsifiers, gelling agents, stabilisers and thickeners) in feedingstuffs for all animal species, with no minimum or maximum content.

3.2. Safety

The safety of guar gum was assessed by JECFA (1970, 1974, 1975), the Scientific Committee for Food (SCF, 1978) and most recently by the EFSA ANS Panel (2017). To support the safety of the additive, the applicant made reference to the conclusions reached in these evaluations, but made available for the assessment only some of the studies used by EFSA in its previous evaluation. The main results of the previous assessments are summarised below, in the respective sections.

In addition, the applicant conducted two literature searches to identify in the scientific literature data which could support the safety of the additive. The first one was done using PubMed as database platform, covering the period between years 2016 and 2021, and using as keywords: guar gum; E 412.[13] The second one was done using 50 cumulative databases (including LIVIVO, AGRICOLA, MEDLINE, PubMed and OVID, 15 single databases, and 8 publisher databases including IngentaConnect, Wiley, and SpringerLink), using as keywords: guar gum; Glucotard; guar flour; guaran; slocose; supercol or 9000-30-0, and limiting the search to cats and dogs.[14]

3.2.1. Absorption, Distribution, Metabolism and Excretion

In its assessment of guar gum as a food additive, the ANS Panel considered the available *in vitro* (several animal species and humans' gut bacteria) and *in vivo* (rats) studies (EFSA ANS Panel, 2017). The ANS Panel concluded that 'Overall, data on *in vitro* degradation by human gastrointestinal fluids and on *in vivo* digestibility of guar gum in animals demonstrated that this compound would not be absorbed intact or hydrolysed by digestive enzymes. However, guar gum would be fermented with production of [short chain fatty acids] SCFAs such as acetic, propionic and butyric acids, during its passage through the large intestine by strains of bacteria found in the human colon. Based on the available knowledge on the role of SCFA as end products of the fermentation of dietary fibres by the anaerobic intestinal microflora (den Besten et al., 2014; Topping and Clifton, 2001), the Panel considered that their potential formation as fermentation products from guar gum does not raise any concern. Despite the absence of convincing *in vivo* study in humans, the Panel considered that these data indicate that guar gum would most probably not be absorbed but significantly fermented by enteric bacteria in humans'.

The FEEDAP Panel supports the above conclusions and does not see any reasons to consider that the additive would behave differently in the gut of the target species.

[12] Technical dossier/Supplementary Information (August 2016)/2_Annex_EFSA_Q-2013-01024_FAD-2010-0391_Guar Gum_rev_July2016_fin.
[13] Technical dossier/Supplementary Information April 2021/Annex 1-1.
[14] Technical dossier/Supplementary Information April 2021/Annex 2-1 t.o annex 2-4.

3.2.2. Toxicology

3.2.2.1. General toxicology

For the current evaluation the applicant submitted the relevant studies that were evaluated in the EFSA ANS Panel opinion (EFSA ANS Panel, 2017) and additional papers from the literature (see Section 3.2).

Regarding general toxicity, the ANS Panel assessed several acute (rat), subacute and short-term (in rats) studies, seven subchronic studies (in mice, rats, dogs and monkeys), two carcinogenicity studies (in rats and mice), five reproductive developmental toxicity studies (in mice, rats, hamsters and rabbits), and a series of case reports and clinical studies in humans. The ANS Panel concluded that 'Short-term and sub-chronic studies on guar gum have not shown major adverse effects under the conditions of the tests. Repeated oral administration of guar gum caused some growth reduction in rats, mice and rabbits at high doses, but these effects can partially be attributed to the bulk properties of guar gum when in contact with water or intestinal juices and have not been considered as adverse effects. Increased caecum weight in animals fed high amounts (2–5% of the diet) of guar gum was also reported. [No observed adverse effect levels] NOAELs identified in short-term and sub-chronic studies correspond to the highest dose tested of ~ 18,000 mg guar gum/kg bw per day for rats and of approximately 15,000 mg/kg bw per day for mice (Graham et al., 1981; NTP, 1982)'. The ANS Panel also reported that 'Guar gum has been tested in several species in long-term chronic and carcinogenicity studies up to doses of 7,500 mg/kg bw per day in mice and 2,500 mg/kg bw per day in rats (NTP, 1982)', and that 'The Panel considered guar gum as not carcinogenic. The Panel could derive a NOAEL of 2,500 mg/kg bw per day, the highest dose tested, from this study. The carcinogenicity study with guar gum in mice did not show carcinogenicity potential either. The Panel could derive a NOAEL of 7,500 mg/kg bw per day, the highest dose tested, from this study. Guar gum did not show reproductive effects (fertility) or developmental toxicity effects in the available studies (FDRL, 1972, 1973). From a combined fertility/developmental study in rats (Collins et al., 1987), the Panel could identify a NOAEL of 5,200 mg/kg bw per day for reproductive effects based on decreased number of corpora lutea and a NOAEL for developmental toxicity of 11,800 mg/kg bw per day the highest dose tested'.

The applicant retrieved 30 publications on ADME or toxicology of guar gum which were published after the opinion of the ANS Panel was delivered (EFSA ANS Panel, 2017). None of these studies was designed to study the toxicological effects of guar gum, most of them were designed to study the effects on intestinal microbiota or performance of various animals. None of these studies was therefore further considered for the assessment of the safety of guar gum.

The FEEDAP Panel, having reviewed the relevant studies previously evaluated by the ANS Panel, supports the above conclusions.

3.2.2.2. Genotoxicity

The ANS Panel assessed several *in vitro* and *in vivo* studies (investigating induction of gene mutations, mitotic recombination and chromosomal aberrations) and concluded: 'The Panel considered the available genotoxicity data on guar gum (E 412) to be sufficient to conclude that there is no concern with respect to genotoxicity'.

The original report of the studies on which these conclusions were based were not made available by the applicant. The FEEDAP Panel could not evaluate the genotoxicity studies done with guar gum.

On the basis of the information provided in the ANS opinion, the FEEDAP Panel would support the conclusions therein reached. However, in the absence of the original reports of the studies on which these conclusions were based, the FEEDAP Panel cannot fully evaluate the potential genotoxicity of guar gum in the framework of its authorisation as a feed additive.

3.2.3. Safety for the target species

To support the safety for the target species, the applicant has submitted one study in trout. In addition, a literature search was conducted, focusing in particular on publications related to the use of guar gum in dogs and cats (see Section 3.2).

3.2.3.1. Tolerance study in trout

A total of 750 female rainbow trout (body weight 50 g, 129 days of age) were distributed in 15 tanks (50 fish each) and allocated to 5 dietary treatments (3 replicate tanks per treatment).[15] Two basal diets (one fed up to 100 g of body weight (bw) and the second one form 100 to 200 g bw),

[15] Technical dossier/Supplementary Information February 2020/Annex 1-12_Signed GCP study Report_Guar gum 47103.

containing 15% fish meal, were either not supplemented (control) or supplemented with guar gum to provide 1,000 (recommended use level), 3,000 (1× highest recommended level in the present study), 6,000 (2×) or 9,000 (3×) mg/kg feed (confirmed by analysis). Diets were offered ad libitum (10% overfeeding) in pelleted form for 94 days. Mortality and health status were checked daily. Animals were individually weighed on days 1, 24 and 94, feed intake was registered per pen and feed to gain ratio calculated. Blood samples were obtained from 10 fish per tank at the end of the trial for haematology and blood biochemistry.[16] The same ten fish were subject to necropsy. An analysis of variance (ANOVA) was done considering the treatment as the effect. Group means were compared with Tukey test. Significance level was set at 0.05.

Only one fish was culled in the study. No significant differences between treatments were observed in any zootechnical parameters (control group values: specific growth rate 2.67, feed intake 2.46 % of bw/day and feed to gain ratio 0.85), as well as in organ indices. Regarding blood parameters, some differences among groups were observed for haemoglobin, cholesterol and lactate dehydrogenase. However, the effects were not dose-dependent nor treatment related.

Rainbow trout tolerated up to 9,000 mg guar gum/kg feed, therefore an inclusion level of 3,000 mg guar gum/kg feed is considered safe for trout, with a margin of safety of 3. This conclusion is extended to salmon.

3.2.3.2. Safety for all animal species

None of the studies identified in the literature search performed to support the safety for the target species (see Section 3.2) could be considered, because of the shortcomings in the study design and of the lack of the endpoints and parameters considered necessary for the assessment of the safety for the target species. A maximum safe concentration of the additive in complete feed could be derived using the results of the toxicological studies (EFSA FEEDAP Panel, 2017b). Among the studies evaluated in the assessment, the FEEDAP Panel considered that the results of the chronic toxicity study in rats are the most appropriate to identify a NOAEL (2,500 mg/kg bw per day). An uncertainty factor of 100 was used to cover the intra- and interspecies variation. The results are reported in Table 1.

Table 1: Maximum safe concentration in feed of guar gum for different target animal categories

Animal category	Default values		Maximum safe concentration in feed (mg/kg feed)(1)
	Body weight (kg)	Feed intake (g DM/day)	
Chicken for fattening	2	158	278
Laying hen	2	106	415
Turkey for fattening	3	176	375
Piglet	20	880	500
Pig for fattening	60	2,200	600
Sow lactating	175	5,280	729
Veal calf (milk replacer)	100	1,890	1,164
Cattle for fattening	400	8,000	1,100
Dairy cow	650	20,000	715
Sheep/goat	60	1,200	1,100
Horse	400	8,000	1,100
Rabbit	2	100	440
Dog	15	250	1,320
Cat	3	60	1,100
Ornamental fish	0.012	0.054	4,889

DM: dry matter.
(1): Complete feed DM = 88%, milk replacer DM = 94.5%.

The calculated safe values ranged between 278 mg/kg feed in chickens for fattening and 4,889 mg/kg feed in ornamental fish. However, considering that the genotoxic potential of the additive could

[16] Haematocrit, haemoglobin, Na, K, Cl, P, total protein, albumin, globulin, cholesterol, creatinine, bilirubin, acute phase protein, amylase, alanine aminotransferase, lactate, dehydrogenase, alkaline phosphatase, creatinine kinase.

not be fully assessed, the FEEDAP Panel is not in the position to conclude on a safe concentration for reproductive and long living animals.

The FEEDAP Panel concludes that guar gum is safe up to approximately 280 mg/kg complete feed for chickens for fattening, 375 mg/kg complete feed for turkeys for fattening, 500 and 600 mg/kg complete feed for piglets and pigs for fattening, respectively, 1,150 mg/kg complete feed for veal calves, 1,100 mg/kg complete feed for cattle for fattening, 440 mg/kg complete feed for rabbit; and, from the results of a tolerance study, the Panel also concludes that 3,000 mg guar gum/kg complete feed is safe for salmonids.

3.2.4. Safety for the consumer

The additive is not absorbed as such in the gastrointestinal tract of the target animals. Its fermentation products in the gut (SCFAs) will be metabolised following the normal metabolic pathways of such substances. Any deposition of the additive or its fermentation by-products in tissues and products from animal origin is unlikely. Since no exposure of the consumer to the additive or its metabolites is expected, the use of the additive in animal nutrition is considered safe for the consumer.

3.2.5. Safety for user

The limited data provided show that the additive has a high dusting potential (2.2–2.6 g/m^3). Exposure via inhalation is therefore possible.

No information was provided on the potential inhalation toxicity of the additive, its irritant potential for skin and eyes and on its sensitisation potential.

In the absence of data, no conclusions could be drawn on the safety of the additive for the user.

3.2.6. Safety for the environment

Guar gum is a natural plant derived product whose components are ubiquitous in nature, therefore its use in animal nutrition is considered safe for the environment.

3.3. Efficacy

The applicant has provided a study to support the efficacy of agar gum as a gelling agent, stabiliser and thickener. No evidence was provided on the effect of the additive as an emulsifier.

The gel strength of a jelly of three canned chunk feed (two feeds for cats and one for dogs) prepared with the unsupplemented or supplemented jelly (740 mg guar gum/kg jelly) was measured.[12] The two feeds for cats had moisture content of 81.5 and 80.9%, the feed for dogs 79.4%. The gel strength was tested in feed with and without chunks and measured with a rheometer, measuring the viscosity, using probes of 32.5 or 14 mm depending on the feed. Five cans for each jelly preparation and for each feed were measured, immediately after preparation and after 3 and 6 months of storage. No statistical analysis was reported. The results of the analysis of the jelly and of the feeds are reported in Table 2.

Table 2: Gel strength measured in three feedingstuffs for pets supplemented with guar gum

Type of feed	Chunks	Guar gum (mg/kg)	Viscosity (mPa.s) Average (±SD)		
			Time (months)		
			0	3	6
Jelly steam oven feed for cat	No	0	6 (±0)	4 (±1)	8 (±1)
	No	740	117 (±2)	98 (±13)	88 (±7)
	Yes	0	192 (±6)	220 (±21)	92 (±61.3)
	Yes	740	1,966 (±92)	1,251 (±98)	1,484 (±38)
Jelly chunk feed for cat	No	0	4 (1)	2 (±0)	8 (±1)
	No	740	106 (±20)	75 (±10)	67 (±7)
	Yes	0	12 (±1)	11 (±1)	14 (±1)
	Yes	740	527 (±38)	653 (±11)	568 (±39)

Type of feed	Chunks	Guar gum (mg/kg)	Viscosity (mPa.s) Average (±SD)		
			Time (months)		
			0	3	6
Jelly steam oven feed for dog	No	0	7 (±0)	6 (±1)	9 (±0)
	No	740	71 (±4)	70 (±4)	71 (±4)
	Yes	0	108 (±16)	75 (±9)	75 (±2)
	Yes	740	796 (±43)	718 (±81)	678 (±26)

The results of the study showed that feed supplemented with 740 mg guar gum/kg feed had a higher gel strength, this effect is maintained for at least six months in canned samples.

The FEEDAP Panel concludes that the additive is efficacious as a gelling agent, thickener and contributes to stabilise canned pet feed. In the absence of data, no conclusion can be drawn on the efficacy of the additive as an emulsifier.

4. Conclusions

From the results of tolerance studies, the Panel concluded that guar gum is safe for salmonids at a maximum concentration of 3,000 mg/kg complete feed. Guar gum is safe up to approximately 280 mg/kg complete feed for chickens for fattening, 375 mg/kg complete feed for turkeys for fattening, 400 mg/kg complete feed for rabbit, 500 and 600 mg/kg complete feed for piglets and pigs for fattening, respectively, 1,100 mg/kg complete feed for cattle for fattening and 1,150 mg/kg complete feed for veal calves. No conclusions can be reached on the safety for long living and reproductive animals, until the genotoxic potential of the additive is fully assessed in the framework of its use as a feed additive.

The use of the additive in animal nutrition is considered safe for the consumer and the environment.

In the absence of data, no conclusions could be drawn on the safety of the additive for the user.

Guar gum is efficacious as a gelling agent, thickener and contributes to stabilise canned pet feed. No conclusion can be drawn on the additive as an emulsifier.

5. Documentation as provided to EFSA/Chronology

Date	Event
09/11/2010	Dossier received by EFSA. Guar gum for all animal species. Submitted by A.I.P.G. (Association for International Promotion of Gums).
11/12/2013	Reception mandate from the European Commission
06/08/2014	Application validated by EFSA – Start of the scientific assessment
06/11/2014	Comments received from Member States
28/11/2014	Request of supplementary information to the applicant in line with Article 8(1)(2) of Regulation (EC) No 1831/2003 – Scientific assessment suspended. *Issues: characterisation, efficacy*
05/12/2014	Reception of the Evaluation report of the European Union Reference Laboratory for Feed Additives
29/07/2016	Request of supplementary information to the applicant in line with Article 8(1)(2) of Regulation (EC) No 1831/2003 (Addendum)– Scientific assessment suspended. *Issues: safety for target species*
02/02/2017	Reception of supplementary information from the applicant - Scientific assessment re-started
14/01/2021	Request of supplementary information to the applicant in line with Article 8(1)(2) of Regulation (EC) No 1831/2003 – Scientific assessment suspended. *Issues: safety*
07/04/2021	Reception of supplementary information from the applicant - Scientific assessment re-started
23/03/2022	Opinion adopted by the FEEDAP Panel. End of the Scientific assessment

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Abbreviations

ADI	average daily intake
ADME	absorption, distribution, metabolism and excretion
ANOVA	analysis of variance
ANS	EFSA Scientific Panel on Additives and Nutrient Sources added to Food
ARC	alternatively refined carrageenan
bw	body weight
CAS	Chemical Abstracts Service
CFU	colony forming unit
CV	coefficient of variation
DM	dry matter
EINECS	European Inventory of Existing Chemical Substances
EURL	European Union Reference Laboratory
FAO	Food Agricultural Organization
JECFA	The Joint FAO/WHO Expert Committee on Food Additives
LOD	limit of detection
LOQ	limit of quantification
NOAEL	no observed adverse effect level
SD	standard deviation
SCF	Scientific Committee on Food
SCFA	short-chain fatty acid
TEQ	toxic equivalent
WHO	World Health Organization

Annex A – Executive Summary of the Evaluation Report of the European Union Reference Laboratory for Feed Additives on the Method(s) of Analysis for guar gum

In the current application authorisation is sought under article 10(2) for *Guar gum* under the 'category'/'functional groups' 1(c), 1(d), 1(e) and 1(f) 'technological additives'/'emulsifiers', 'stabilisers', 'thickeners' and 'gelling agents' according to the classification system of Annex I of Regulation (EC) No 1831/2003. Specifically, authorisation is sought for the use of the *feed additive* for all animal species. *Guar gum* is a white to yellowish powder containing a minimum of 75% of galactomannan, a high molecular weight hydrocolloidal polysaccharide composed of galactopyranose and mannopyranose units combined through glycosidic linkages. The Applicant stated that the purity criteria/technical specification set in Commission Regulation (EU) 231/2012 for the food additive apply also to the *feed additive*. The *feed additive* is intended to be incorporated into *feedingstuffs* through *premixtures* with no recommended minimum or maximum inclusion levels.

For the characterisation of *Guar gum* the Applicant submitted the Commission Regulation (EU) 231/2012 which requires a solubility test and the following quantitative assays: - loss on drying; - total ash; - acid insoluble matter; and – protein content. These methods are described in the FAO JECFA Compendium for food additives. These tests are also described in the *Guar gum* monographs of the European Pharmacopoeia. The Applicant suggested additional tests (i.e. viscosity, pH, mesh size) described in the European Pharmacopoeia. Even though no performance characteristics are provided, the EURL recommends for official control the above mentioned methods for the characterisation of *Guar gum* described in the European Pharmacopoeia monographs and in the Commission Regulation (EU) 231/2012.

Since the accurate quantification of *Guar gum* added to *premixtures* or *feedingstuffs* is not achievable experimentally the EURL cannot evaluate nor recommend any method for official control to quantify *Guar gum* in *premixtures* or *feedingstuffs*.

Further testing or validation of the methods to be performed through the consortium of National Reference Laboratories as specified by article 10 (Commission Regulation (EC) No 378/2005) is not considered necessary.