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INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

WORLD HEALTH ORGANIZATION

**TOXICOLOGICAL EVALUATION OF CERTAIN  
FOOD ADDITIVES AND CONTAMINANTS**

**WHO FOOD ADDITIVES SERIES 26**

Prepared by:

The 35th meeting of the Joint FAO/WHO Expert  
Committee on Food Additives (JECFA)

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**The International Programme on Chemical Safety (IPCS)** is a joint venture of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization. The main objective of the IPCS is to carry out and disseminate evaluations of the effects of chemicals on human health and the quality of the environment. Supporting activities include the development of epidemiological, experimental laboratory, and risk-assessment methods that could produce internationally comparable results, and the development of manpower in the field of toxicology. Other activities carried out by the IPCS include the development of know-how for coping with chemical accidents, coordination of laboratory testing and epidemiological studies, and promotion of research on the mechanisms of the biological action of chemicals.

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**PREFACE**

The monographs contained in this volume were prepared by the thirty-fifth Joint FAO/WHO Expert Committee on Food Additives (JEFCA), which met in Rome, Italy, 29 May-7 June 1989. These monographs summarize the safety data on selected food additives and a contaminant reviewed by the Committee. The data reviewed in these monographs form the basis for acceptable daily intakes (ADIs) established by the Committee.

The thirty-fifth report of JECFA will be published by the World Health Organization in the WHO Technical Report Series. The participants in the meeting are listed in Annex 3 of the present publication and a summary of the conclusions of the Committee is included as Annex 4.

Specifications established at the thirty-fifth meeting of JEFCA will be issued separately by FAO under the title, Specifications for the identity and purity of certain food additives in the FAO Food and Nutrition Paper Series. These toxicological monographs should be read in conjunction with the specifications and the report.

Reports and other documents resulting from previous meetings of the Joint FAO/WHO Expert Committee on Food Additives are listed in Annex 1.

JEFCA serves as a scientific advisory body to FAO, WHO, their

Member States, and the Codex Alimentarius Commission, primarily through the Codex Committee on Food Additives and Contaminants regarding the safety of food additives and contaminants in food. Committees accomplish this task by preparing reports of their meetings and publishing specifications and toxicological monographs, such as those contained in this volume, on substances that they have considered.

The toxicological monographs contained in this volume are based upon working papers that were prepared and/or presented by temporary advisers in advance of the 1988 JECFA meeting. A special acknowledgement is given to those who prepared these working papers, Dr Ronald Walker, Professor of Biochemistry, University of Surrey, Guildford, Surrey, England; Drs D. Benz, I. Chen, C.B. Johnson, M. Bleiberg, J. Griffiths, K. Edelman and H. Irausquin, Division of Toxicological Review and Evaluation, Center for Food Safety and Applied Nutrition, Food and Drug Administration, Washington, DC, USA; Dr C.L. Galli, Professor of Toxicology, University of Milan, Italy; Drs D.L. Grant, E. Vavasour, S.G. Gilbert, E.M. Kovacs, P. Nawrot and T. Kemeny, Bureau of Chemical Safety, Foods Directorate, Health and Welfare Canada, Ottawa, Canada; and Dr G.J. van Esch, the Netherlands.

Many proprietary unpublished reports are referenced. These were voluntarily submitted to the Committee by various producers of the veterinary drugs under review and in many cases these reports represent the only safety data available on these substances. The temporary advisers based the working papers they developed on all the data that were obtained, and all these studies were available to the Committee when it made its evaluations.

From 1972 to 1975 the toxicology monographs prepared by Joint FAO/WHO Expert Committees on Food Additives were published in the WHO Food Additives Series; after 1975 this series was available in the form of unpublished WHO documents provided upon request to the Organization. Beginning with WHO Food Additives Series No. 20, which was prepared by the twenty-ninth Committee in 1985 until WHO Food Additives Series No. 24, which was prepared by the thirty-third Committee in 1988, volumes in this series were published by the Cambridge University Press. Beginning with WHO Food Additives Series No. 25, which was prepared by the thirty-fourth Committee, WHO is producing these volumes as priced documents.

The preparation and editing of the monographs included in this volume have been made possible through the technical and financial contributions of the Participating Institutions of the International Programme on Chemical Safety (IPCS), which support the activities of JECFA. IPCS is a joint venture of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization, which is the executing agency. One of the main objectives of the IPCS is to carry out and disseminate evaluations of the effects of chemicals on human health and the quality of the environment.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the organizations participating in the IPCS concerning the legal status of any country, territory, city, or area or its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or

recommended by those organizations in preference to others of a similar nature that are not mentioned.

Any comments or new information on the biological or toxicological data on the compounds reported in this document should be addressed to: Joint WHO Secretary of the Joint FAO/WHO Expert Committee on Food Additives, International Programme on Chemical Safety, World Health Organization, Avenue Appia, 1211 Geneva 27, Switzerland.

#### MONOGRAPH FORMAT

Note: Each monograph in this document follows the general format presented below. Each heading may not, however, be applicable to all monographs.

1. EXPLANATION
2. BIOLOGICAL DATA
  - 2.1 Biochemical aspects
    - 2.1.1 Absorption, distribution and excretion
    - 2.1.2 Biotransformation
    - 2.1.3 Effects on enzymes and other biochemical parameters
  - 2.2 Toxicological studies
    - 2.2.1 Acute toxicity studies
    - 2.2.2 Short-term studies
      - 2.2.2.1-2.2.2.X Species tested
    - 2.2.3 Long-term/carcinogenicity studies
    - 2.2.4 Reproduction studies
    - 2.2.5-2.2.X Special studies
  - 2.3 Observations in humans
3. COMMENTS
4. EVALUATION
  - Level causing no toxicological effect
  - Estimate of acceptable daily intake
  - Further work or information
    - Required for substances given a temporary ADI
    - Desired
5. REFERENCES

See Also:

Toxicological Abbreviations

## GUM ARABIC

### 1. EXPLANATION

Gum arabic, also known as gum acacia, is the dried gummy exudate from tropical and subtropical *Acacia senegal* trees. The exudate is a proteinaceous polysaccharide, the protein content ranging from ca.1.5% to 3% for samples from different producing areas. The proteinaceous components of eight bulk commercial gum arabic samples, and for eleven gum specimens secured from *Acacia senegal* trees show that their amino acid compositions vary considerably, particularly with respect to the three major components (hydroxyproline, serine and proline), although the proportions of other amino acids (e.g., alanine, cysteine, isoleucine, methionine, threonine, tyrosine and valine) are remarkably constant (Anderson *et al.*, 1985). Gum arabic consists of several high-molecular-weight polysaccharides and their salts, which on hydrolysis yield arabinose, galactose, rhamnose and glucuronic acid (Anderson *et al.*, 1983).

This substance was last evaluated for acceptable daily intake for humans by the Joint FAO/WHO Expert Committee on Food Additives in 1982 (Annex 1, reference 59) when a toxicological monograph was prepared and an ADI "not specified" was allocated.

Additional data have become available and are summarized and discussed in the following monograph addendum.

### 2. BIOLOGICAL DATA

#### 2.1 Biochemical aspects

Groups of three male rats (140-160 g) were given diets containing 0, (control), 1, 4 and 8% (w/w) of gum arabic for 28 days. At autopsy (following macroscopical examination of all organs), materials for electron microscopy and for microsomal P-450 assays were secured from all animals. There were no detectable abnormalities in any of the organelles in the heart and liver specimens from any of the test animals and no inclusions nor other pathological changes were observed. In addition, the data indicated that gum arabic did not induce cytochrome P-450 or microsomal protein (Anderson *et al.*, 1984).

#### 2.2 TOXICOLOGICAL STUDIES

##### 2.2.1 Special studies on teratogenicity

###### 2.2.2.1 Rats

Twenty male and female Osborne-Mendel (FDA strain) rats, approximately 4 weeks old, were fed gum arabic *ad libitum* in their diet at 0, 1, 2, 4, 7.5 or 15% for 13 weeks before mating. The animals continued to eat the control or test diet throughout mating and gestation. After mating was confirmed, the females were placed in groups of 41-47 animals. During gestation, the treated females

consumed from 683 mg gum/kg bw/day in the 1% group to 10,647 mg gum/kg bw/day in the 15% group. There were no treatment-related changes in maternal findings, number of fetuses, fetal viability or external, visceral or skeletal variations and no terata were seen (Collins *et al.*, 1987).

### 3. COMMENTS AND EVALUATION

Further findings from teratology and biochemical studies were reviewed. It was concluded that the results of these studies did not modify the previous evaluation. The Committee confirmed the ADI "not specified".

#### Estimate of acceptable daily intake

ADI "not specified". This term is applicable to a food substance of very low toxicity which, on the basis of the available data (chemical, biochemical, toxicological, and other), the total dietary intake of the substance arising from its use at the levels necessary to achieve the desired effect and from its acceptable background in food does not, in the opinion of JECFA, represent a hazard to health. For that reason, and for reasons stated in individual evaluations, the establishment of an acceptable daily intake expressed in numerical form is not deemed necessary. An additive meeting this criterion must be used within the bounds of good manufacturing practice, i.e., it should be technologically efficacious and should be used at the lowest level necessary to achieve this effect, it should not conceal inferior food quality or adulteration, and it should not create a nutritional imbalance.

### 4. REFERENCES

ANDERSON, D.M.W., BRIDGEMAN, M.M.E., FARQUHAR, J.G.K. & McNAB, C.G.A. (1983). The chemical characterization of the test article used in toxicological studies of gum arabic (Acacia senegal (L.) Willd). *Int. Tree Crops J.* 21, 145-254.

ANDERSON, D.M.W., ASHBY, P., BUSUTTIL, B., KEMPSON, S.A. & LAWSON, M.E. (1984). Transmission electron microscopy of heart and liver tissues from rats fed with gum arabic and tragacanth. *Toxicology Letters*, 21, 83-89.

ANDERSON, D.M.W., HOWLETT, J.F. & McNAB, C.G.A. (1985). The aminoacid composition proteinaceous component of gum arabic (Acacia senegal (L.) Willd). *Food Additives and Contaminants*, 2, 159-164.

COLLINS, T.F.X., WELSH, J.J., BLACK, T.N., GRAHAM, S.L. & BROWN, L.H. (1987). Study of the teratogenic potential of gum arabic. *Fd.Chem.Toxic.* 25, 815-821.

See Also:

Toxicological Abbreviations  
Gum arabic (JECFA Evaluation)