The use of ascorbic acid as a food additive: technical-legal issues

Michele Varvara,1 Giancarlo Bozzo,1 Giuseppe Celano,2 Chiara Disanto,3 Cosimo Nicola Pagliarone,3 Gaetano Vitale Celano1

1Department of Veterinary Medicine, University of Bari, Valenzano (BA); 2Department of Soil, Plant and Food Science, University of Bari; 3Mediterranean and Food C.Q.S. Srl, Valenzano (BA), Italy

Abstract

Ascorbic acid (C₆H₈O₆) is an organic compound belonging to the family of monosaccharides. It is highly soluble in water, and is often called one of the secrets of the Mediterranean diet. Its use is widespread in the food industry, which has always used its stabilised and antioxidant properties. Indeed, there are several formations of additives that contain ascorbic acid (Liao and Seib, 1988). The name, ascorbic acid, is derived from the Latin a (meaning no) + scorbutus and refers to scurvy, the disease caused by deficiency of vitamin C especially developed among ship’s crew and known in the past. This disease was frequently indentified in sailors, human beings, as well as primates, bats and some species of birds and fishes, which are not able to synthesise the vitamin C starting from the glucose. This inability derives from the lack of L-gulonolactone oxidase enzyme, responsible for the last metabolic phase necessary to the transformation of the glucose into vitamin C. Therefore, the consumption of ascorbic acid with food rich of this element, like fruits and vegetables, is essential (Ferro-Luzzi et al., 1994). One of the most important characteristics of the ascorbic acid is its reducible capacity. In the presence of oxygen, ascorbic acid tends to oxidise with a strong result, especially in relation to catalyst metals, removing the environmental resources of oxygen. Furthermore, the ascorbic acid can react with free radicals, arresting the chain reactions that may provoke dangerous effects on organisms, such as neoplastic pathologies of the oral cavity, alimentary system, etc. (Cerutti, 2006). It allows maintaining stable other important elements, such as vitamin A, E, folic acid and thiamine in organisms and foods (Mora-Gutierrez and Gurin, 2006) and it is essential for synthesis of collagen, connective issue’s protein, important to heal wounds, sores and lesions, and to the prevention of hemorrhages. In addition to prevent the onset of the atherosclerosis, vitamin C contributes to the development of the adrenaline and the endogenous serotonin and to the hydroxylation of aromatic compounds in the liver. It operates in processes of the cellular defense, facilitates the intestinal absorption of the iron and the elimination of toxic heavy metals (such as cadmium, nickel and lead) with which it is able to tie. Its action is also important in the synthesis of the carnitine in the zymotic transformation of the cholesterol in bile acid or in vitamin D.

The strong antioxidant activity of the ascorbic acid, linked to the ability to establish other elements and essential nutritional factors, encouraged industries to formulate some specific additive for the use of this substance in different food products (Cappelli and Vannucchi, 2009). The food additive could be any substance, not generally used like food itself, but added to foods to different technical purposes, among which their retention (Reg. EC 1333/2008; European Commission, 2008). There are several additives arisen from the ascorbic acid that nowadays we can find in trade: E300, ascorbic acid; E301, sodium ascorbate; E302, calcium ascorbate; E303, potassium ascorbate; E304, fatty acid esters of ascorbic acid (ascorbyl palmitate and ascorbyl stearate). These additives use the ascorbic acid itself (E300) or in the form of salts (E301, E302, E303) or lipophilic esters. Lipophilic esters (E304) are arisen with long fatty acid’s chain to be able to use the effects of ascorbic acid even in lipodic foods, preventing the rancidification (Morrisey et al., 1998).

All additives based on ascorbic acid – except for the E303 potassium ascorbate – are approved in Europe, USA, Australia and New Zealand. In these nations the use of E303 is also approved. Additives, based on ascorbic acid, are used in production and transformation phases of several foods such as beer, gelatines, jam, sweets, bread and baked products, fruit juices, wine, fishing products and meats (Bauerfeld et al., 1970; Liao et al., 1988). The use of additives based on ascorbic acid is approved by current regulations, even in products for infants and children’s feeding (Reg. EC 1129/2011; European Commission, 2011).

The use of the ascorbic acid is important, especially in production activities of the ground meat and cold cuts (Varnam and Sutherland, 1995). In meat and ground meat the ascorbic acid prevents the oxidation and the discoloration of the product during the sto-
The use of additives in foods is regulated in Italy by D.M. 209/1996 (Italian Republic, 1996), which for the first time introduced the concept of the use of these substances, defining the maximum dose and limitation of employment. This national law has been the only one that regulates the use of additives in food productions in Italy since the introduction of hygienic packages and following laws. The introduction of hygienic packages introduced several laws that, today, regulate food productions in European Community. The Regulations EC 178/2002, 852/04, 853/04 (European Commission, 2002, 2004, 2004) introduced new and essential principles in activities related to the food production and new responsibilities for the FBO. Then, even the European legislator issued laws regarding the use of food additives. The recent law, currently in force, is represented by the Reg. EC 1129/2011 (European Commission, 2011), which modified the II Attachment of the Reg. EC 1333/08 (European Commission, 2008), establishing a list of food additives authorised by European Union, and then integrated by the Reg. EU 231/2012 (European Commission, 2012), which establishes specifications for several additives.

All sector law was object of search of this work and it was interpreted and applied at this specific case, regarding the protest of the illicit use of the ascorbic acid in meat preparation as the ground meat (which preserves its muscle fibrosis structure, according to the definition of meat preparation – Reg. 853, all. I, point 1.15; European Commission, 2004). Furthermore, the concentration found in the official sample has connected to limitations established from legislation to some product typology (especially those designed for the weakest categories at risk) and through information presented in the international scientific bibliography, to evaluate the real risk of the additive in these doses.

Limitations and definitions, presented in law deeds and also technical-legal reflections on the mixture composition, containing the ascorbic acid, were used by technical adviser as support for the defense of the accused at legal argument.

Results

The D.M. 209/1996 (Italian Republic, 1996), already described before, indicates the modality, limitations and bans of the use of food additives.
principle is said even in the specific section of the Regulations for the preparation of meats with a clear reference to the possibility of use E300, E301 and E304 in the pre-packed preparation of the ground meat in a quantity that can be modified, according to the choice of the FBO, without risks for the consumer health. In support of the safe use of the ascorbic acid, there is also the possibility of use it as additive in some products for infants, as declared in the Reg. EC 1129/2011. There is a maximum fixed doses of the ascorbic acid that can be used in these foods and on the other hand, in products that differ from the productions of meat.

The Community Regulations and Ministerial decree authorise the use of additives, based on ascorbic acid in the pre-packed production of the ground meat. On the basis of how said before, the interpretation of law sector is clear, because identifies the ascorbic acid as a substance that contain toxicity, absolutely negligible. Moreover, several studies testify the absence of dangerous reaction in men, related to the toxicity of the molecule that is essential fort the organism’s functions. In scientific literature, there are not events of toxicity or episodes of dangerous events related to the consumption of food products that contain additives with ascorbic acid.

Moreover, for the purposes of suggest proper deposition at legal argument, the technical adviser found in product’s sample a low concentration of the ascorbic acid. The analysis on the official sample, made in laboratory, identify a concentration of the 70 mg/kg of the ascorbic acid in the product. This result is lower than that provided for the national and community law, about ascorbic acid contained in food productions for infants (200-300 mg/kg, according to the type of food production for infants). The thesis presented by the technical adviser, who is on the side of the accused in this legal argument, underlined the nontoxic molecule, explained by definitions, attended in the sector law and by different scientific studies against the use of limited quantity as that contained in the premix mixture used in this specific case. Accordingly to what emerged from this debate and especially after concepts expressed by the technical adviser, the accused has been acquitted because the fact does not subsist.

Discussion

The definition of the pre-packed ground meat under the Reg. EC 853/04, requests a common recognition, for its production, under the same Regulations. But, according to an organoleptic point of view and a flow of process, the ground meat produced by registered factory is like that of pre-packed for definition, coming from a factory with a common identification number, for which the use of a non-toxic additive is considered possible, even in authorised factories, both by national and common Legislators. It is important to underline that the solubility of the ascorbic acid allows an important renal excretion of an excessive levels of this substance (Cerutti, 2006).

Moreover, the ability of absorption, expressed by the organism, diminishes from the 75-95% (normal levels) to the 16% with the growth of the ascorbic acid concentration in blood and in organs (especially adrenal glands, hypophysis and corpus luteum in which, the molecule contains an high level of concentration).

Toxic effects of the molecule are verified especially in gastrointestinal and renal side, but they are also related to unbalance diet and not to the ingestion of food additive with the ascorbic acid. Indeed, as said before and paid attention to the judge in legal head office, in literature there are not toxic additives based on ascorbic acid in men, as testified by the principle of quantum satis (just enough), expressed by the current regulations in matter of the use of these food additives.

According to what emerged during the debate, especially to what said by the technical adviser, the accused has been acquitted because the fact does not subsist, and also because the use of the additive did not represent a risk for the consumer health. This type of sentence opens new technical-legal sceneries for the use of the ascorbic acid in food productions, and especially in the production of the ground meat and other type of meats. Indeed, the sentence above-mentioned disclosed that established by the Reg. EU 601 of the June 4th 2014 (European Commission, 2014), which clarified the transfer concept of additives in the preparation of the meat, already related in the Reg. 1333/2008. According to the Reg. EU 601/2014 above-mentioned, the European Union allows the application of the transfer principle of additives (art. 18 of the Reg. EC 1333/2008) in the preparation of meats. Therefore, allowing the presence of additives in these preparations, even if they are not authorised for this product category and not intentionally used by the producer in order that, the same additives will be, at least authorised in one of the ingredients of the same preparation of meat. Obviously, this principle is applied even in the use of the ascorbic acid in ground meats that could be ingredients used in preparations of different type of meat.

The Reg. EU 601/2014 (European Commission, 2014) represents also an important response to the need and requests of explanations about the transfer principle, shown by several producing associations and Veneto region to the Ministry of Health, culminated in the well-known newsletter prot. 18.03.2014 of the Ministry (Italian Republic, 2014). Limited index of manageability of the ascorbic acid, which legitimises the use of it only in recognised factories, has never been defined by sector laws. The application of normal hygienic customs and precise producing phases, the implementation of self control methods, based on the hazard analysis and critical control points principles, allow to equalise the producing activity of the authorised factory and that of the recognised factory, under the Reg. EC 853/04, which refers to the use of not dangerous substance, such as the ascorbic acid.

The non-toxicity of these additives, recognised by the community and national legislation and by experts of the scientific sector, associated to positive effects on their production and conservation (Okayama et al., 1987; Sanchez-Escalante et al., 2001), allow to use the ascorbic acid in for small and medium-sized enterprises of the food sector, which can be compared to the most important enterprises, and can respect the law and guarantee the correct information and the absolute tutelage of the consumer’s health.

Conclusions

Reasons of the sentence of the Court of Trani based on the molecule, which is not dangerous, are used to make jurisprudence, and they open new sceneries and reflections on the use of ascorbic acid in food enterprises.

References


European Commission, 2004b. Regulation of


