

## EVALUATION OF INTOLERANCE TO FOOD PRESERVATIVES BY NON-INVASIVE BIOPHYSICAL TECHNOLOGIES

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### ABSTRACT

Food preservation represents one of the main interests of food science, and various synthetic and natural compounds are available nowadays for food industry. A high concern exists among consumers towards the toxicity of food additives and preservatives, in particular, however the role that some of these compounds can have in causing food intolerance to consumers should be underlined.

In this work we evaluated the feasibility of using an unconventional diagnostic procedure based on bioelectrical skin responses referred to as Electro-Acupuncture Diagnostics according to Voll (EAV) based on the variations of conductivity or cutaneous electric potential in correspondance with the points of acupuncture meridians and due to the interaction between the electromagnetic waves, spontaneously emitted by certain substances, and the human organism. This technique could provide a fast, easy, non invasive and sensitive evaluation of the irritating potential of food preservatives. Four of the most commonly used preservatives in food industry (EDTA, lactoferrine, lisozyme and nisin) were assessed on 20 healthy volunteers. This preliminar study pointed out that the tested preservatives can cause intolerance in sensitive individuals, but further studies are needed to consider the effect of concentration of the pure substances, and of food containing such preservatives on determining intolerance.

Key words: intolerance disease, food preservatives, non-invasive analytical techniques, EAV

## INTRODUCTION

Food preservation represents one of the main interests of food science, and various synthetic and natural compounds are available nowadays for food industry. A high concern exists among consumers towards the toxicity of food additives and preservatives, most of which are obtained through chemical synthesis. Therefore, much interest has been focused in the last years on natural preservatives, such as lysozyme, lactoferrin and nisin (often coupled with EDTA to enhance its antimicrobial effect), used with the aim of extending the shelf life of various products, which are thought to be healthier; however the role that some of these compounds can have in causing food intolerance to consumers has not been studied yet. The last decades have been characterized by an exponential progress of knowledges in the scientific field, which have undisclosed the extremely complex nature of the living systems. Such advances allow to understand that at the basis of the cellular transmission there is not only a biochemical message, but also an electromagnetic one. Many unconventional diagnostic procedures based on bioelectrical skin responses are widely used for allergic diseases. The perturbation of the skin electrical response is evoked by a process of bioresonance (Puzzo *et al.*, 2001). According to Voll (1975) the electromagnetic frequencies typical of test substances can be sent to the patient via cables and their effects on the organism can be determined by means of Electro-Acupuncture Diagnostics according to Voll (EAV). Previous studies showed that the EAV acupuncture technique, based on bioelectrical skin responses, and in particular on the variations of conductivity or cutaneous electric potential (in correspondance with the points of acupuncture meridians) due to the interaction between the electromagnetic waves, spontaneously emitted by certain substances, and the human organism, could be regarded as a useful test to evaluate food allergy (Puzzo *et al.*, 2001, Tsuei *et al.*, 1999). Since this diagnostic technique is fast, easy to perform and non-invasive, it could provide an alternative method to patch test and prick test to evaluate the allergenic potential of several substances. Previous studies have pointed out a correspondance >76% between EAV and the prick test (Figure 2), moreover, a further validation of data was obtained by the comparison between diagnostic data obtained with EAV and with Patch test (Figure 3) in the essay of the intolerance to some basic components used in the preparation of cosmetic products. The aim of the present study was to evaluate the feasibility of using Electro-Acupuncture Diagnostics according to Voll (EAV) to test intolerance to some natural food preservatives.

## MATERIALS & METHODS

EDTA, lysozyme and nisin were purchased from Sigma-Aldrich (Milan, Italy), lactoferrin was kindly supplied by Glanbia Nutritional (Monroe, WI, USA).

### *Subjects*

EAV tests were performed on 20 healthy volunteers of both sexes in the age range 18-60. The participants did not suffer from any ailment and were not on any medication at the time of the study. The volunteers were fully informed of the nature of the study and the procedure involved. They were rested for 15 min prior to the tests and room conditions were set at  $22 \pm 2^\circ\text{C}$  and 40% relative humidity.

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### EAV tests

EAV bioresonance tests were performed using a Bicom 2000 (Brugermann GmbH, Germany, agent for Italy Medisoft Italia, Milan) equipped with an electrodermal screening device (EDS) (Figure 1). This instrument is basically a galvanometer that measures current variations of acupuncture points and has been used to indicate the energetic state of meridians for the diagnosis and the treatment of body disorders. The device Bicom measures the skin conductivity at acupuncture points via two electrodes. One electrode is a brass cylinder with a large surface and has to be kept by the subject in his hand; the other electrode (stylus) has a small contact area and delivers a direct current (approximately 1 V), by applying a slight pressure at chosen skin meridian points. The body impedance between the skin point and the hand electrode is then measured: the value is shown on an analogical device with an arbitrary scale reading from 0 to 100 units. The operator was an experienced acupuncturist physician. As there is a great variability of skin conductivity among individuals due to a number of factors (skin thickness, humidity, blood flux), a baseline level of resistance

was determined for each subject by placing a brass electrode in each hand. The subject was considered "in balance" if the instrument readings were at approximately 80% of the full scale. Subjects with readings below 70% and above 90% were disqualified from the study. Then, the level of conductivity of the terminal point of the meridian selected was measured in the absence of the test compounds, and the value was taken as the reference baseline value. A vial containing the preservative to be tested (Figure 3) was put in a metal vial-holder electrically connected to the hand electrode via Bicom device. Skin conductivity was then measured for each

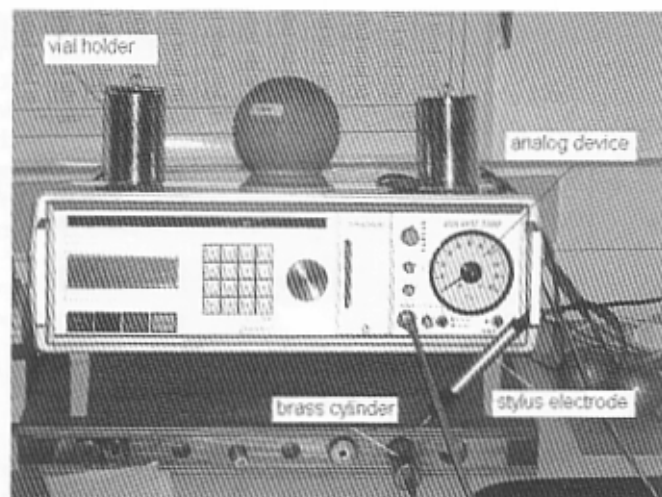


Fig. 1. The Bicom device.

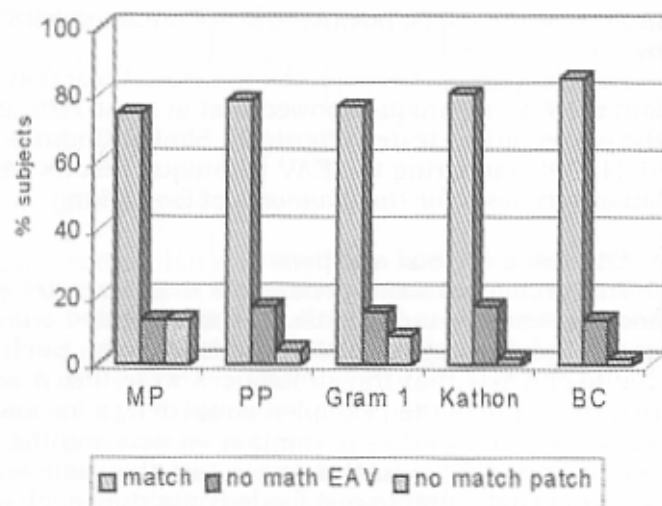


Fig. 2. Validation of EAV test against Patch test. Percentages of subjects showing the same results using patch and EAV tests (match) or a positive response only to patch test (no match patch) or a positive response only to EAV test (no match EAV) for each cosmetic preservative assayed.

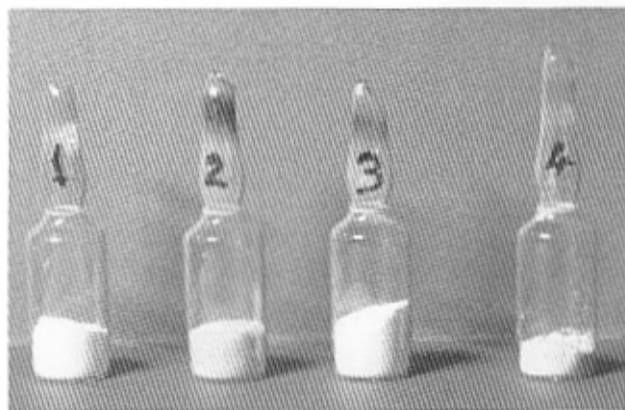


Fig. 3. Vials containing the substances to be tested.

correspondance of 75 % between the evaluation with the bioresonance test and data obtained with the prick test (considering positive and negative results). Moreover, in 80% of the cases positive results obtained with the prick test were confirmed by the EAV test.

The comparison between the individual reactions observed using the patch test and the EAV technique showed that at least 70% of the responses matched for all the preservatives tested (Figure 2). Similar findings have been reported by Tsuei et al. (1999) comparing the EAV technique results with those obtained by routinely laboratory tests for the diagnosis of food allergy.

#### *EAV test with food additives*

This preliminar study pointed out that the tested preservatives can cause intolerance in sensitive individuals. The test pointed out an incidence of 47% for EDTA, and 41% for lysozyme, nisine and lactoferrin. Such high percentages are probably due to the fact that the substances were tested as received (powder). It is likely that the use of diluted samples would determine lower percentages. Future studies will consider the effect of dilution on determining intolerance in tested subjects. Moreover, it will be interesting to test the same substances at the concentration of use in foods, and to test foods containing such additives. The determination of a threshold or a minimum concentration for the onset of intolerance could help food scientists and the food industry to consider the combinate use of different preservatives at lower concentrations instead of fewer or single additives at potentially harmful concentrations.

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of the substances placed in the vial-holder. A positive reaction to the compound being tested was recorded as a decrease from the baseline value. The same concentrations of preservatives used for the patch test were analysed.

#### RESULTS AND DISCUSSION

##### *Validation of the method*

The validation of the EAV method against the usual diagnostic method gave a statistical

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