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Authenticity of Emmentaler Cheese Switzerland™

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In co-operation with the Swiss Federal Office of Public Health (SFOPH), the Swiss Federal Dairy Research Station at Liebefeld (FAM) is undertaking a broad study on the authenticity and the geographic traceability of Emmentaler cheese Switzerland™ (a Swiss-type cheese) within the framework of the national project "CH-CHeese Authenticity". This investigation is also a potential component of a future European project entitled "GEO-FOOD EU Research Training Network: Geographical Origin of Food" whose objectives are analogous.

Introduction

The 5th European Symposium on Food Authenticity, 9–11 June 1999 in La Baule (F) (1) highlighted the fact that food misrepresentations and adulterations are distinguished both by their abundance and their variety. For the detection of these misrepresentations, analytical methods represent one technique among several, such as the inspection of companies and the control of their accounting. It is by using this technique that several countries succeeded in discovering irregularities of production ("scriptural controls"). Even though the control of accounts is certainly a very fast and successful tool, the suspicions should nevertheless be confirmed by using selective, targeted and reliable analytical methods.

The imminent opening of the Swiss cheese market will certainly allow a massive importation of authentic well known foreign cheeses, but also of more or less successful cheap industrial imitation products, which will probably be difficult to identify. Therefore the problem of the analytical authentication of Swiss cheese types will be a major challenge in the near or more distant future both for people responsible for suppression of misrepresentations as well as producers and people responsible for the sale of Swiss cheeses.

Analytical authentication involves characterising as exactly and exhaustively as possible the Swiss production on the one hand, i.e. Emmentaler Switzerland™, and the foreign replacement products on the other hand, especially for young cheeses (3–5 months). The former has already been investigated within a broadbased study on 50 samples (2), but only little information and few data are currently available for the foreign products.

The accumulation of comparative scientific data from this project for numerous authentic Emmentaler Switzerland™ and foreign Emmment(h)al(er) cheeses or even "Swiss type cheeses" could also be interesting for the European Union not only for the current negotiations within the Codex Alimentarius, but also to improve the geographic traceability of foods. This is a topic of the new European project entitled "GEO-FOOD EU Research Training Network" which was discussed on 2 April 2001 in Brussels. It is recognised that the consumers of all the countries are interested in knowing the geographic origin of their foods. These reasons range from an understandable patriotism, often linked with an increased respect for the environment, to a lack of confidence. This lack of confidence in foods is always more intense due to the globalisation of the farm-produce industry. The regional, often artisan or craft products (3), have in fact acquired a brand image due to their purity, their high quality related to the "terroir", their production using natural methods (e.g. label "organic") and a traditional process. This tendency explains the success of labels such as Protected Designation Origin (PDO) (in French AOC or AOP) (4).

Objective and strategy

The Swiss Federal Office of Public Health requested the FAM to characterise a Swiss cheese which is easy to imitate abroad such as the Emmentaler Switzerland™, and later possibly another cheese such as the Swiss Gruyère cheese, in order to identify it i) in a piece; ii) grated (e.g. in a mixture for fondue) or iii) in a processed cheese *vs* comparable samples made and ripened abroad.

This study will be carried out within the Ph.D. of Mr. L. Pillonel scheduled from March 2001 to December 2003 under the supervision of Dr J.O. Bosset. Prof. R. Tabacchi of the Institute of Chemistry of the University of Neuchâtel will be the director of this Ph.D. The participation of the FAM will include all the following activities: the scientific and technical environment of the candidate, the bibliographic study, the choice of the geographic regions of interest, sampling, preparation and distribution of the samples to the different participating laboratories, performance of numerous routine chemical analyses statistical evaluation, interpretation and presentation of results as reports, joint publications or posters with the other participants, and final writing of this thesis.

It is not possible to study all the cheese varieties at the same time. Therefore it was necessary to choose a representative cheese type. The method used in this first step to characterise the latter may then be applied later to other types of cheeses, notably to PDO cheeses.

The typical features of a cheese, changes with maturity and degree of ripening, have to be determined. Young cheeses of the type Emmentaler Switzerland, e.g. 3–5 month old, are the most susceptible to fraudulent substitution by foreign mass produced, very cheap homologues as suggested by the annual productions of this cheese variety for 1997 in the following countries: Switzerland 45 000 t (CH = × 1), France 275 000 t (F = × 6), Netherlands 89 400 t (NL = × 2), Germany 88 300 t

(D= $\times 2$), Sweden 28 400 t (= $\times 0.6$), Finland 26 400 t (Fi=0.6), Austria 12 800 t (In= $\times 0.3$), Denmark 6 600 t (DK= $\times 0.1$), Ireland 5 000 t (IR=0.1), for a foreign world production of more than 500 000 t ($\times 11$).

Analytical methods

Numerous analytical methods (chemical, physical, chemico-physical, rheological, microbiological and sensory analysis) will be used, some of which are routinely used in the FAM. Others will be performed in external laboratories including several Swiss and foreign specialists, in order to have as broad as possible a range of techniques.

The analytical investigation of the inorganic fractions of non-smear cheeses seems very promising due to their relatively low sensitivity both to the mode of manufacture and mode of ripening, especially as regards Emmental cheeses ripened in dry cellars. These cheeses are neither smeared nor salted. Inorganic analyses are generally used to follow the traceability and the geographic authenticity of wines (5), butters (6) and oil (7). Due to the extreme complexity of the problem considered, it is necessary to apply simultaneously numerous organic and inorganic instrumental methods such as mass spectrometry and atomic emission spectroscopy of stable and radioactive isotopes, measurements of the radioactive β and γ emissions etc.

The results obtained using these different methods will finally be treated by multivariate statistical analyses (8–10) to find the most significant regressors able to discriminate between the geographic origins of hard cheeses. No element and no analytical method considered on its own is likely to be capable of producing such traceability.

Planning of the project: duration, milestones and output

This project is planned for a period of three years.

The first year (2001) will be dedicated to the following investigations:

- A bibliographic search on the authenticity of foods, particularly in cheeses.
- A preliminary trial (screening test) including 21 samples of cheeses from seven regions, each containing three samples per region. Two regions will represent Switzerland. Five others were chosen to get “Emmental or “Swiss” type cheese” of interest as imitation or replacement products for a potential misrepresentation of origin, notably those manufactured in adjacent countries such as France (Emmental cheese of Savoie and industrial Emmental cheese of Bretagne), Germany (Allgäu), Austria (Vorarlberg), as well as Finland. In this way it should be possible to estimate the variability/variance, both inter- and intraregional, and to select the best regressors for the follow-up of the project.

- Statistical multivariate analyses, interpretation and writing of an intermediate report as well as one or several joint publication(s), in an international scientific journal to present this study, its results and its conclusions.

On the basis of the previously acquired bibliographic data as well as the experimental results obtained during the first year of this project and its preliminary conclusions, the second year (2002) will extend these results by considerably increasing the number of samples analysed. Only the most discriminating regressors (analytical methods), which were found to be reliable for the identification of the geographic origin of the cheeses, will be used. This phase of the study should then take into account all the possible sources and origins of the labelling compounds selected for the follow-up of the project, and not only those related to cheese manufacture (processing) and ripening. All labelling compounds of interest will be investigated, especially those that are dependent on the feeding of the cattle (plants, water) in order to discriminate between local and external intake (i.e. pasture *vs* concentrates). This should make it possible to prevent erroneous results and wrong conclusions from the aforementioned study. At this stage of the investigation, the number of regions studied will be increased to include all other European countries that produce Emmental or "Swiss type cheese". At the end of this second year, it should be possible to map regions with higher risks and to identify their cheeses, namely those most likely to mimic Emmentaler Switzerland™ or to be confused with it. A second intermediate scientific report and one or several paper(s) will be written.

The third and last year (2003) will allow us to complete the aforementioned project by acquiring missing data and confirming those previously obtained. Eventually further cheese varieties will be studied. The theoretical models, the EU-cartography and the analytical techniques will be refined if necessary. This year will also be dedicated to producing further publications as well as the manuscript for the thesis. At the end of this project, it should be possible to give to people responsible for both food analysis and regulation (legal enforcement aiming to protect the consumer against deceptions or falsifications) and Swiss cheese manufacturers (including also the circuits of sale and distribution) the know-how and technical means for fighting such misrepresentations or substitutions.

The publication and the diffusion of the results obtained are key elements in the strategy of this project. They should indeed make it possible:

- to counteract food misrepresentations by developing and testing new analytical tools in both Swiss and foreign control laboratories on a scientific basis recognised by the international community;
- to discourage potential cheats by informing them about possibilities of being discovered;
- to increase the confidence of the consumer in local and DPO products;
- to acquire the scientific knowledge necessary to take decisions within the framework of the topic raw *vs* pasteurised milk cheeses (Codex Alimentarius).

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