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Poster 3

Traceability of organic food – analytical authentication of processed dairy products

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Objective

Recently, analytical parameters obtained by stable isotope and fatty acid analysis have been established for the authentication of organic drinking milk in Germany. The aim of the present work was to confirm the proposed threshold values for $\delta^{13}C$ and the α-linolenic acid (C18:3ω3) content in milk fat to be applicable with processed dairy products. Moreover, procedures for the authentication of reconstituted products require including not only the fat component but protein as well. Such laboratory methods being capable of differentiating between organic and conventional products are intended to be applicable at the retail level in order to improve the capability of protecting consumers and organic milk producers against potential fraud.

Materials and Methods

During a period of 18 months, 3 conventionally and 3 organically produced brands of German full cream milk were collected at retail every 4 weeks (n=120). Milk fat and protein were subjected separately to stable isotope analysis of carbon. Moreover, a variety of processed organic dairy products were obtained during a period of 2 years (n=56 in total) with a focus on cream cheese and curd (n=39). The extracted milk fat was analyzed for fatty acids (C18:3ω3) and carbon isotopes ($\delta^{13}C$). From a selection of 17 cream cheese and curd samples $\delta^{13}C$ was analyzed also in protein. The fatty acid composition of milk fat (g/100 g of fatty acids) was analyzed by GC of FAME (60-m Sil88 column). The stable isotope ratio of carbon ($\delta^{13}C$, in ‰ against PDB) was determined by IRMS of CO_2 after combustion of the samples in an elemental analyzer.

Results

The analysis of milk samples revealed a very close correlation of r=0.99 between δ^{13}Cfat and $\delta^{13}C_{protein}$, while the $\delta^{13}C$ level in protein on average was 2.6‰ higher than in fat. Consequently, $\delta^{13}C$ in both fat and protein can be used to authenticate organic milk products by a maximum level of 26.5‰ in fat and -23.5‰ in protein. Milk fat extracted from both soft and semi-hard cheeses, butter, cream, sour cream, buttermilk, yoghurt and low-fat milk always showed an α-linolenic acid (C18:3ω3) content above the minimum level of 0.50% and a stable isotope ratio of carbon ($\delta^{13}C$) below the maximum level of 26.5‰ required for organic milk according to our previous examination of German drinking milk (n=246). Results beyond these thresholds were were obtained for whey, because of its special lipid composition, as well as both Italian ice creams and cheeses. Analyses of cream cheese and curd lipids revealed that also 7 out of 39 samples did not comply with these two thresholds. An additional analysis of δ13C in the protein fraction showed that these reconstituted products apparently contained a combination of organic skim milk and conventional or imported organic cream. The inherent correlation between δ13C in fat and protein indicated their different origins by an actual deviation between $\delta^{13}C_{protein}$ and $\delta^{13}C_{fat}$ of less than 1.0‰.

Conclusions

This study showed that the previous C18:3ω3 and δ13C thresholds derived from fresh milk are generally applicable to processed dairy products from Germany. Non-organic constituents can be identified by correlating $\delta^{13}C$ in protein and fat, which may provide evidence of fraud.

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