

Dried fruit and its functional properties from a consumer's point of view

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SUMMARY

Modern drying technology provides the opportunity to obtain dried fruits with high concentrations of bioactive compounds. Such products may also be fortified with functional ingredients. The adoption of dried fruit as a carrier of functional ingredients for consumers is indispensable to launch this kind of product successfully on the market. Thus, the aim of this study was to collect data on consumer perceptions and interests in dried fruits (plain or fortified) through a questionnaire distributed on the Internet to 1,092 Dutch, French, and Polish respondents. In this quantitative study, the respondents were first asked to rank statements about a product with different positive influences on human health. Products which lowered the risk of cancer or heart diseases were mainly of interest to Polish and Dutch respondents, whereas French consumers emphasised the prevention of intestinal problems. Furthermore, we checked the level of consumer interest in dried fruits enriched with a particular functional ingredient (e.g., anti-oxidants, natural fruit sugars, or prebiotics). Products with anti-oxidants seemed to be the most promising in all three countries investigated. Among five different forms of product (i.e., candy, fruit teas, cereals, bars, or cookies) in which dried fruit could be incorporated, cereals were selected by approx. 33% of all respondents as the best product to which a functional dried fruit could be added. In summary, dried fruits can be adopted as carriers of functional ingredients, especially when promoted as a source of anti-oxidants.

Exploitation of dried fruit as a carrier of functional ingredients is a relatively new concept, although the functional properties of such products originated from the nature of drying process, where the removal of water leads to a natural concentration of healthy fruit components. Even taking into consideration the fact that traditional drying technology leads to serious losses of bioactive compounds, dried fruit can still be a valuable source not only of energy, dietary fibre and minerals, but also of anti-oxidant activity. Natives in Canada used to dry berries in order to have enough vitamin C during the off-season to protect them against scurvy (Turner, 1997). Due to the application of modern technology, the matrix of fruits and vegetables can be fortified with health-promoting compounds such as prebiotics, vitamins, or minerals. This is considered to be an important area for future research into the development of functional food markets (Alzamora *et al.*, 2005; Fito *et al.*, 2001). Based on the natural potential of fruit, and the opportunities offered by modern technology, the idea arose within the ISAFRUIT Integrated Project to develop novel, convenient, dried fruit products with functional properties that could contribute to the increased consumption of healthy products.

New food product development, especially those with functional properties, represents a high risk for any company (van Trijp and Steenkamp, 2005; van Kleef

et al., 2002; 2005). Statistics show that many functional food products, even when developed from a sound scientific point of view, encounter poor market acceptance (Hilliam, 1998). Approx. 75% of newly-launched food products are withdrawn from the food market during their first 2 years (Menrad, 2003). Consumer acceptance of a specific functional ingredient is linked to consumer knowledge of its health effects, thus, the first essential step in product development is to explore which diseases consumers are actually concerned about (van Kleef *et al.*, 2005; Menrad, 2003). To consume functional foods, consumers also need to know what benefit they will get from consuming a particular food, and why (Wansink *et al.*, 2005). For many years, in the European Union, using disease-related information on packages or in product advertisements for a functional food was forbidden (Menrad, 2003). In July 2007, regulations on the nutritional and health claims that can be made for a food were introduced (EC Reg. No. 1924/2006). This provides the food industry with new legislation opportunities to design innovative products with added nutritional value (Schaafsma and Kok, 2005). Apart from the proper formulation of health claims, the product should also be presented in an attractive form so that consumers can accept easily it (van Kleef *et al.*, 2005).

To increase the chance of consumer adoption of any novel dried-fruit product, this quantitative study was undertaken to address consumer perceptions of dried

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fruit (plain or fortified). The main aim of this study was to obtain information on consumer perceptions of dried fruit as a carrier of functional properties, taking into account consumer interest in different functional ingredients as well as the form of product in which a dried fruit with functional properties could be incorporated. The investigations were carried out among Dutch, French, and Polish respondents, who declared consumption of dried fruit, or products with dried fruit, at least once a month.

MATERIALS AND METHODS

In total, 1,092 consumers from France, The Netherlands, and Poland took part in the survey concerning dried fruit and dried fruit products. The questionnaire was originally sent to 1,217 respondents through the Internet. The data presented in this article concern only the functional properties of dried fruits and food products in general. Respondents who were in the habit of eating dried fruit at least once a month were targeted. The Dutch respondents seemed to be less familiar with dried fruit than the Polish respondents (Jesionkowska *et al.*, 2007). Therefore, consumers who also declared they ate products containing dried fruit, such as cookies and cereals, at least once a month were taken into account.

Formulation of the questionnaire

To have an insight into whether or not consumers perceived dried fruit as a source of nutritional ingredients, respondents were asked to express their level of agreement with the following five statements:

- I eat dried fruits because they are a source of vitamins
- I eat dried fruits because they are a source of sugar
- I eat dried fruits because they are a source of minerals
- I eat dried fruits because they are a source of fibre
- I eat dried fruits because they are a source of energy

Only respondents who declared dried fruit consumption answered this question.

Positive or negative attitudes to statements concerning nutritional ingredients were marked on a 5-point Likert scale (1 = I totally agree, to 5 = I totally disagree). Moreover, the possibilities: 'I don't know' and 'No answer' were also available.

For data analysis, the scale was reversed to facilitate graphic presentation of the results.

Respondents also had to rank functional products with a particular beneficial influence on human health from the most interesting (1), to the least interesting (5). The following descriptions were presented to the respondents:

- Products which prevent intestinal problems
- Products which lower the risk of heart illness
- Products which lower the risk of cancer
- Products which do not cause tooth decay
- Products which give you energy in a natural way

Later, two questions concerning dried fruit as a carrier of functional ingredients were asked. Anti-oxidants, natural fruit sugars, and prebiotics were taken into account as they can easily be offered with dried fruit. These ingredients were chosen based on technological premises. Anti-oxidants (e.g., vitamin C, anthocyanins) occur in abundance in certain fruit species (e.g., sour

cherries, blackcurrants) and, due to modern drying technology, can be concentrated; while prebiotics and natural fruit sugars can easily be added during a process of osmotic infusion.

To be sure that all the respondents understood the influence of the functional ingredients mentioned on human health, a short description of each particular ingredient was attached. The level of consumer interest was measured on a 5-point Likert scale (1 = extremely interesting; 5 = not at all interesting). The answers 'I don't know' and 'no answer' were also available. In this case, the scale was also reversed for data analysis.

As dried fruit with functional properties can be a component of other products, respondents were asked to choose the best form of product (e.g., candy-like, fruit teas, breakfast cereals, muesli bars, or cookies) in which dried fruit with functional properties could be incorporated.

Statistical analysis

To evaluate the differences between the three nationalities, one-way ANOVA was used. Moreover, a *post-hoc* Duncan's MRT test was performed to check whether there were differences between particular statements within one nationality.

RESULTS AND DISCUSSION

Perception of dried fruit as a carrier of nutritional values

A summary of the data concerning respondent motivations for dried fruit consumption is presented in Figure 1. Polish respondents were most positive about all statements describing dried fruit as a source of nutritional ingredients. Dutch consumers were negative about the statement that they ate dried fruit because it was a source of sugar, and neutral when it came to the sentence that dried fruits were sources of minerals. All nationalities claimed that they ate dried fruit mainly because it was a source of energy. This is in agreement with the perception of one of the most popular dried fruits, plums, which are a good source of energy (Stacewicz-Sapuntzakis *et al.*, 2001). However, Dutch



FIG. 1

Levels of consumer agreement towards statements concerning their consumption of dried fruit because of the presence of certain nutritional ingredients. An asterisk denotes significant differences between nationalities at $P \leq 0.05$. The insert in the top left-hand corner shows the outcomes of Duncan's MRT test. Ingredients marked with the same lower-case letter do not differ significantly within one nationality at $P \leq 0.05$.

respondents appreciated the presence of fibre in dried fruit more than energy, whereas Polish consumers mostly preferred dried fruit as a source of vitamins. In contrast, French consumers agreed less with the statement that they ate dried fruit because it was a source of vitamins.

Consumer interest in food products with a positive influence on human health

Concerning products with a positive influence on human health, Dutch and Polish respondents were highly interested in products which could reduce the risk of heart disease or cancer (Figure 2). Approx. 52% of these respondents claimed that they were most (or only) interested in food which could lower the risk of heart disease. A high level of interest was expressed in products that lowered the risk of cancer, this was indicated by 45.9% of Polish consumers and 54.8% of Dutch consumers. Although French consumers also appreciated products which lowered the risk of heart diseases or cancer, they ranked food which could prevent intestinal problems more highly. This finding is consistent with a study by Bech-Larsen *et al.* (2001), where the majority of Danish, Finnish, and American consumers preferred products which lowered the risk of heart disease. Moreover, according to Cathro and Hilliam (1993), heart disease was ranked highly by UK and German respondents; but, in France, it was placed behind stress and migraine. The high interest of French respondents in products that prevented intestinal problems may be due to an increase in marketing of functional dairy products (Euromonitor, 2004).

Consumer interest in dried fruit as a carrier of functional ingredients

All three nationalities agreed that they were highly interested in dried fruit with anti-oxidant properties (Figure 3). These findings may have a connection with the high level of appreciation by consumers of products that lower the risk of cancer because, in the statements presented to respondents, anti-oxidants were mentioned as ingredients which may decrease the risk of cancer. In experiments conducted by Sosińska *et al.* (2006), 55% of Polish and 49% of Belgian respondents admitted that they did not know about the influence of anti-oxidants on human health. However, Bech-Larsen *et al.* (2001) argued that an elaborated claim can have a positive effect on the acceptance of a functional ingredient which is still unknown to consumers. Thus, high consumer interest in dried fruit with anti-oxidants may have arisen from the proper explanation of the influence of anti-

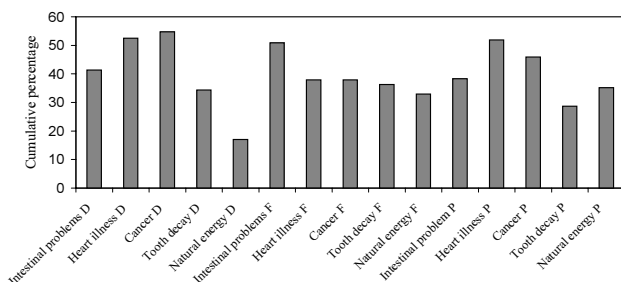


FIG. 2

Cumulative percentages of respondents who ranked products with a particular positive influence on human health as interesting or most interesting. Bars for the Dutch respondents are marked with a D, for the French with an F, and for the Polish with a P.

Consumer interest in dried fruit with certain functional properties

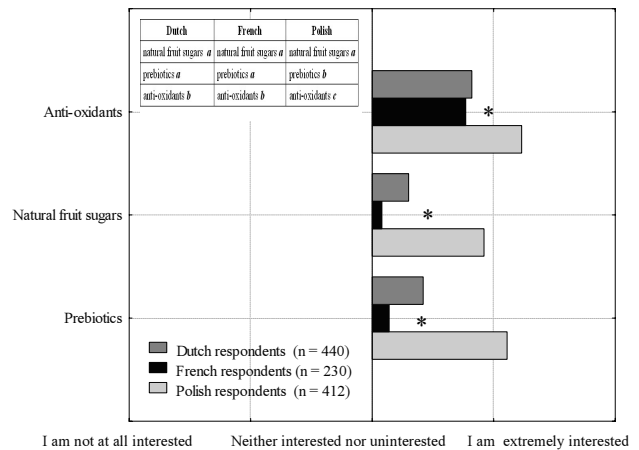


FIG. 3

Level of consumer interest in products containing dried fruit with certain functional ingredients. An asterisk denotes significant differences between nationalities at $P = 0.05$. The insert in the top left-hand corner shows the outcomes of Duncan's MRT test. Functional ingredients marked with the same lower-case letter did not differ significantly within one nationality at $P \leq 0.05$.

oxidants on human health.

Although all nationalities claimed that they ate dried fruits for energy, dried fruit with added natural fruit sugars was perceived as the least interesting. Possibly, the word 'energy', which evokes more positive connotations, should replace the word 'sugar'.

Consumer preferences towards the form of a product with dried fruit

Both the substance used for enrichment, and the type of product being enriched, strongly affected consumer attitudes towards functional products (Jonas and Beckmann, 1998; Poulsen, 1999). Thus, consumer preferences towards the form of a product with dried fruit containing three different functional ingredients were measured (Figure 4). Approx. 33% of all respondents preferred cereal as the form of product in which dried fruit with anti-oxidants or prebiotic additions could be incorporated. Dutch respondents were also in favour of cookies, whereas Polish respondents preferred fruit teas. This finding may

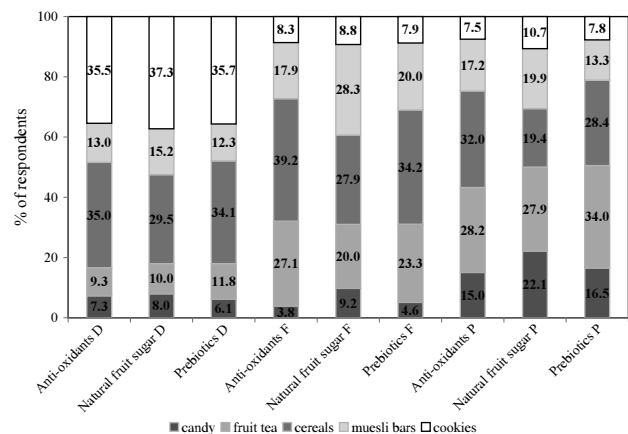


FIG. 4

Consumer preferences towards certain forms of products containing dried fruit. Columns for the Dutch respondents are marked with a D, for the French with an F, and for the Polish with a P.

indicate that respondents preferred those products in which they ate dried fruit more often (Jesionkowska *et al.*, 2008). Products usually recognised as unhealthy (e.g., candies, bars) could benefit from enrichment in a functional ingredient.

In this study, a tendency was observed that consumers appreciated candies and muesli bars with dried fruit and with natural fruit sugars. It seems that this type of product could benefit from adding dried fruit with natural fruit sugars. Similarly, Bech-Larsen *et al.* (2001) noticed that consumers do not increase the healthiness of yoghurts and juices with functional ingredients because these products are already perceived as being healthy *per se*. In contrast, spreads could benefit from functional enrichment, because this product is perceived as inherently unhealthy.

CONCLUSIONS

1. All three nationalities agreed that they ate dried fruit because it was a source of energy. Moreover, Dutch respondents appreciated the presence of fibre most

highly, whereas Polish consumers ranked the content of vitamins most highly.

2. Both Dutch and Polish respondents ranked products which could lower the risks of cancer and heart disease as the most interesting, while French consumers chose products that could prevent intestinal problems.

3. It can be concluded that dried fruits may be accepted as products with functional characteristics, especially, when their anti-oxidant properties are emphasised.

4. Cereals were pointed out to be the best product for incorporating dried fruit with anti-oxidants or prebiotics by approx. 33% of respondents.

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