Fruit and vegetable by-products and breakfast cereals products: can they meet?

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This work aimed to review the application of fruit and vegetable by-products into breakfast cereals products based on extrusion process.

Fruit and vegetable by-products
They are peels, stems/cores, leaves, pomaces, unripe or damaged fruit/vegetable. Correspond to ~14% of all food produced¹ and ~50% of industrial manufacturing². Rich in fibre: from 30 to 90% of dry weight. Rich in bioactive compounds (mostly bound to the fibre): phenolic acids, flavonols, flavonoids, flavanones, flavones, coumarins, anthocyanins, carotenoids, tocotrienols.

Health benefits: antioxidant activity, gut microbiota improvement, satiety increase, lower energy intake, prevention of chronic diseases (diabetes, obesity, cancers, cardiovascular diseases).

Breakfast cereals products
Health benefits are related to their fibre content: reduce risk for several diseases, including obesity, and are a good source of vitamins and minerals³. However, they have both limited type and amount of fibre⁴ and its consumption is associated with higher intakes of total sugars⁵.

How can they meet? The method, advantages and challenges

1st Transform by-product into flour:
Extraneous material
Seeds
Other applications
Juice

Washing
Sieving
Mechanical treatment

Pomace/Bagasse
Drying
Grinding and sieving

Flour

Fruit/vegetable by-product

Cereals flour

Advantages
- By-product flour:
  - ↑ fibre content
  - ↑ antioxidant activity and health benefits
  - ↑ bioactive compounds content

Extrusion processing:
Improves dietary fibre profile (↓ insoluble and ↑ soluble dietary fibre).
- ↑ antioxidant activity and health benefits by releases bound phenolics from fibre.

Challenges
- By-products flours:
  - ↓ texture quality (↑ hardness and bulk density, ↓ crispiness)

Extrusion processing:
- ↓ free bioactive compounds content from by-products flours
  BUT
  Processing conditions may be optimized to overcome these difficulties, namely, moisture content, screw speed and barrel temperatures

2nd Formulation and Extrusion processing:

Motor
Barrel
Motor
Screw
Sample

Die

System flow

Advantages
Conclusions
To improve the bioactive compounds content and biological properties of these products, the flours’ production process must be as mild as possible, in order to avoid the loss of free bioactive compounds at this stage so they can be released during extrusion instead. Extrusion technology is a promising technique to create high fibre breakfast cereal products through incorporation of fruit and vegetable by-products flours, once several processing conditions must be controlled to improve texture quality of the product assuring at same the increasing fibre content.

References

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