Food and Nutrition Skills - An Industry Perspective

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Abstract

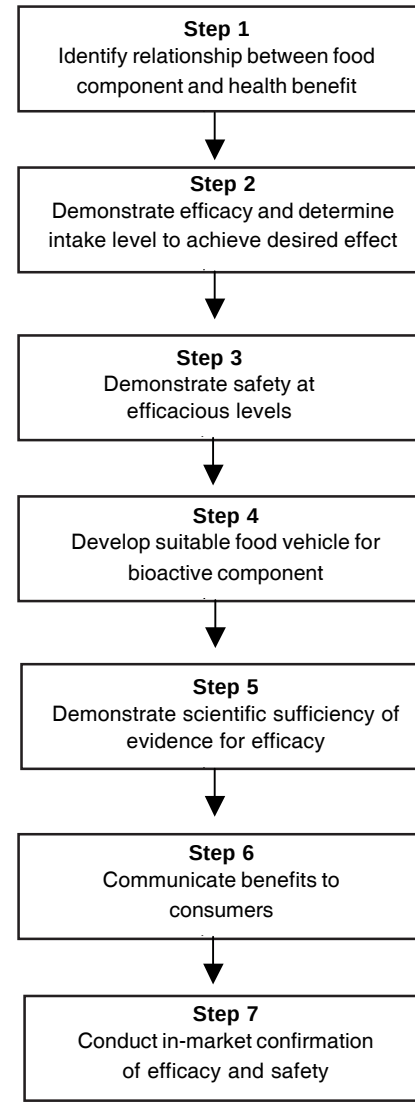
When designing products for sale to consumers who have a choice it is important to have many skills beyond that of nutrition science. Knowledge of consumer habits, designing for good sensory properties is important if a product is to be relevant.

Understanding product safety is key in the modern world. Use of computer models can speed up product design. An efficient supply chain , knowledge of cost optimization and process and equipment design is important for efficient product delivery. Skills development in education program to address these needs will be vital in the modern food industry.

1.0 Bringing nutritional foods to market an overview

1.1 Seven Steps for Bringing Nutritional Foods to Market

The steps are illustrated in the following diagram.



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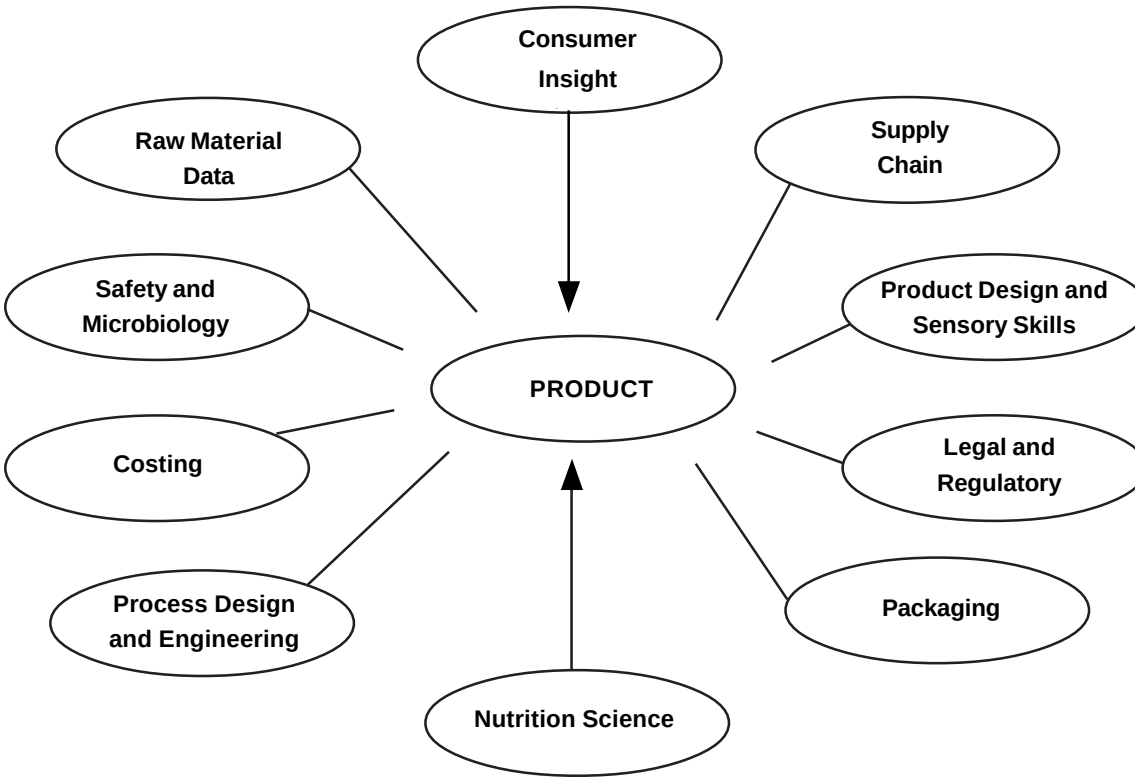
1.2 Designing products for the market

When a product is to be brought to the market place many disciplines and expertise areas are involved. These are illustrated below in the figure.

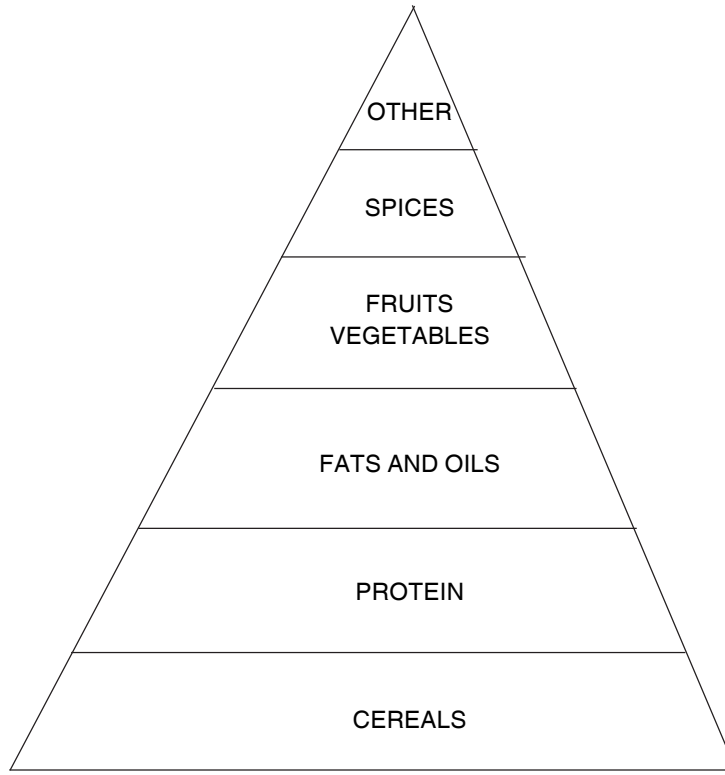


2.0 Consumer insight skills for Category Selection

2.1 Understanding the food pyramid

Understanding what type of food is to be fortified of nutritionally enhanced is a choice based on the food habits in a society. For example a solution aimed at the base of the food pyramid would be very different to the solution aimed at the top of the food pyramid.

FOOD CONSUMPTION PYRAMID



2.2 Understanding of Consumers

When addressing the issue of product design it is important to take in to account the following

- Understanding food habits meal inventory
- Cooking and meal preparation
- Consumer concerns

While from a scientific point of view one may have a solid case consumers perceptions are often based on fear of packaged foods . A quote from a consumer (mother) is given :" I am skeptical about the nutritive value of most packaged foods except a few"

It is important to realize the following:.

- Mothers lay stress on home made food
- Reluctance to experiment with new food brands is high
- Only certain packaged categories are nutritious
- Mothers are skeptical about "real nutritive" value of packaged foods and tonics. Yes it is investment in faith.
- Health concerns on packaged food high due to preservatives etc.

3.0 Quantitative Sensory skills

Use of quantitative sensory methods coupled to quantitative consumer testing is powerful tool forgetting directions for product development.

The steps in such a process are typically:

- Skills to set up sensory panels to generate quantitiative scores on product attributes
- Quantitative Consumer Preference Mapping

- Interpretation of data using multivariate statistics

4.0 Predictive Microbiology for Safe product Design

Currently the way the microbiological safety of products is often designed is by either using broad rules based on water activity , preservative conten, thermal treatment etc.

A better way is to understand the kinetics of microbial growth and growth inhibition based on the chemical environment a microbe is confronted with. It is also important to understand phonomena such as the solubility of various components in various phases in a product and information of dissociation constants of organic acids.

Computer models can then be built to predict the microbiological stability of products. It is therefore possible to design products in a systematic manner.

For example in designing a dressing containing oil and water such a mayonnaise the following has to be considered.

- Organic acids acetic acid and benzoic acid soluble in both oil and water

- D – Partition Coefficient Oil/Water
  Acetic Acid 0.05
  Benzioc Acid 10

- Dissociation constants (pK Values)
  Acetic Acid 4.76
  Benzoic Acid 4.19

- Based on the partition coefficients and the dissociation constants it is possible to predict the amount of undissociated acid available in the aqueous phase. It is the undissociated acid which is inhibitory to microbes.

5.0 Supply Chain Innovations

Supply chain innovation are needed to cut costs and improve quality.

For a typical large tomato processing plant the following issues arise.

- Max distance 600 km. for fruit to be transported
- Juice loss (close to 10%), during transportation, due to long time of transportation, coupled with heat and bad conditions of transportation.
- Losses at the factory in case any breakdown, due to over – ripening of fruits.

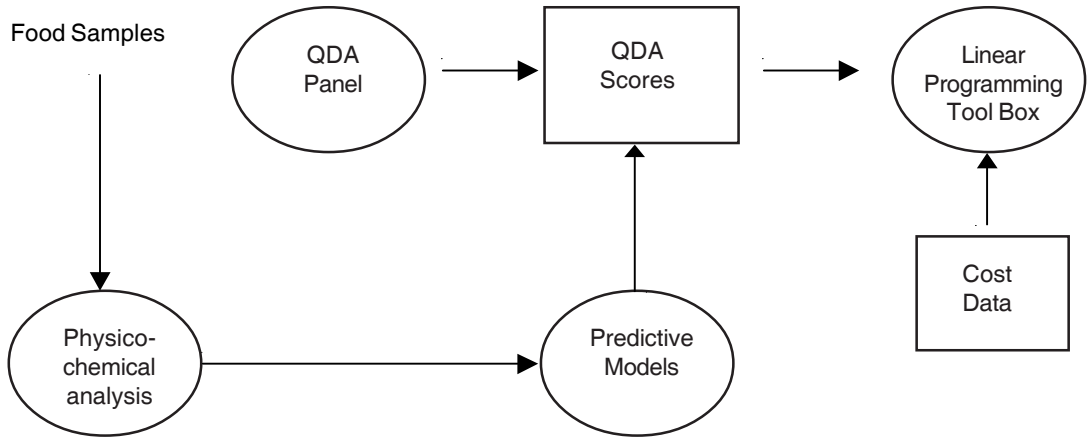
One innovative way to address is to take the processing to the farmgate. Mobile factories can be designed which operate in the fields. Waste such as stems leaves etc can also be discarded in the fields reducing the waste disposal problem. A lot of transit loss can be avoided.

6.0 Product Cost Optimization

Combining quantitative descriptive analysis (QDA) which is a powerful sensory profiling tool with optimization techniques such as linear programming results in optimally costed products which meet all sensory requirements. Products can thus be designed systematically.

In the diagram given below a schematic of such a process is given.

SOFTWARE FOR BLENDING



A linear programming software would need the following input data for a *chapati*

- Cost Data C1, C2, C3, ------ Cn
- Taste score T1, T2, T3, ------Tn
- Softness score S1, S2, S3, ------ Sn
- Nutrition scores N1, N2, N3, ------ Nn

The problem would then be set up as follows:

- Minimise Blend cost = W1.C1 + W2.C2 + ------ + Wn.Cn
- Subject to Constraints

Taste W1.T1 + W2.T2 + ------ + Wn.Tn > A
Softness W1.S1 + W2.S2+ ------ + Wn.Sn < B
Nutrition W1.N1 + W2.N2 + ------ + Wn.Nn > C

Where A, B and C are some chosen values.

7.0 Using process modeling to design equipment

By modeling the flow of fluids such as tomato paste it is possible to design equipment such as evaporators which cause minimal thermal damage.

By getting data on viscosity of tomato paste as a function of shear rate

$$\mu a = kx (\dot{r})^{n-1}$$

The Reynolds number and pressure drop can be calculated

$$\text{Reynold Number} = \frac{DVS}{\mu a}$$

$$\Delta P = \frac{2Ke}{R} \cdot \left(\frac{1 + 3n}{4n} \cdot \frac{4G}{\Pi R}\right)^{n}$$

From this the flow velocity in tubes of evaporators can be calculated.

If the rate kinetics of the destruction of a nutrient due to heat are known in the form of an equation such as the one given below.

- $R = a \cdot \exp(-E/RT)$

Combined with simulation of fluid flow gives overall destruction of a nutrient. Equipment can then to minimize such destruction.

8.0 Conclusion

In today's food industry to deliver nutritionally effective, safe, cost effective and desirable products needs integration of many disciplines. This has been illustrated with examples in this paper.