

# The role of cereals in the industry of plant-based foods

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## Introduction

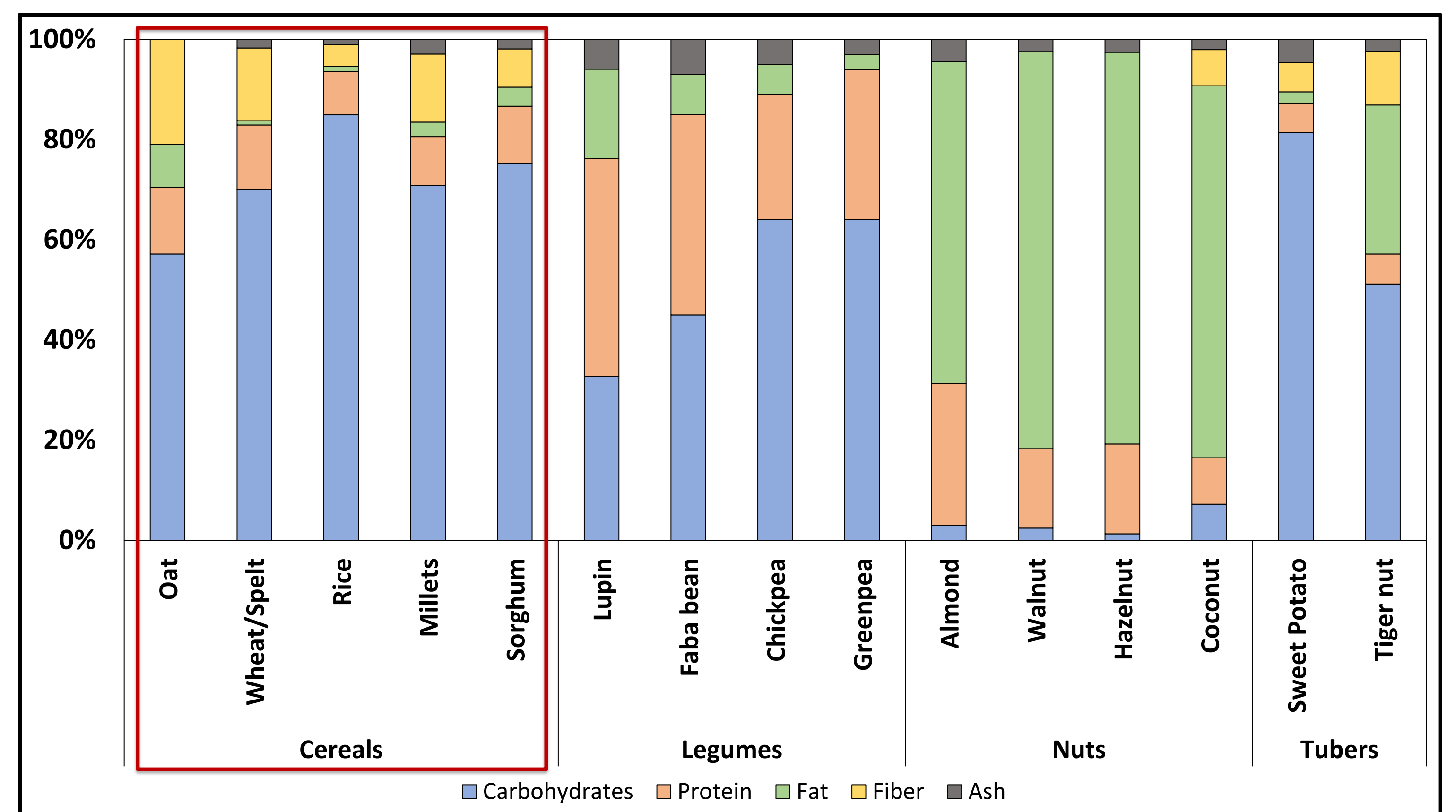
Current trends in human feeding promote a more **plant-based diet**, for several reasons [1]. Ethical and environmental concerns are among the most common reasons why people chose to avoid animal-based products [2], [3]. Also, there is an increasing perception that the excessive consumption of animal-based products is associated with higher risk of developing chronic diseases [4].

Thus, the demand for **innovative and sustainable plant-based solutions** is increasing exponentially. Such products must:

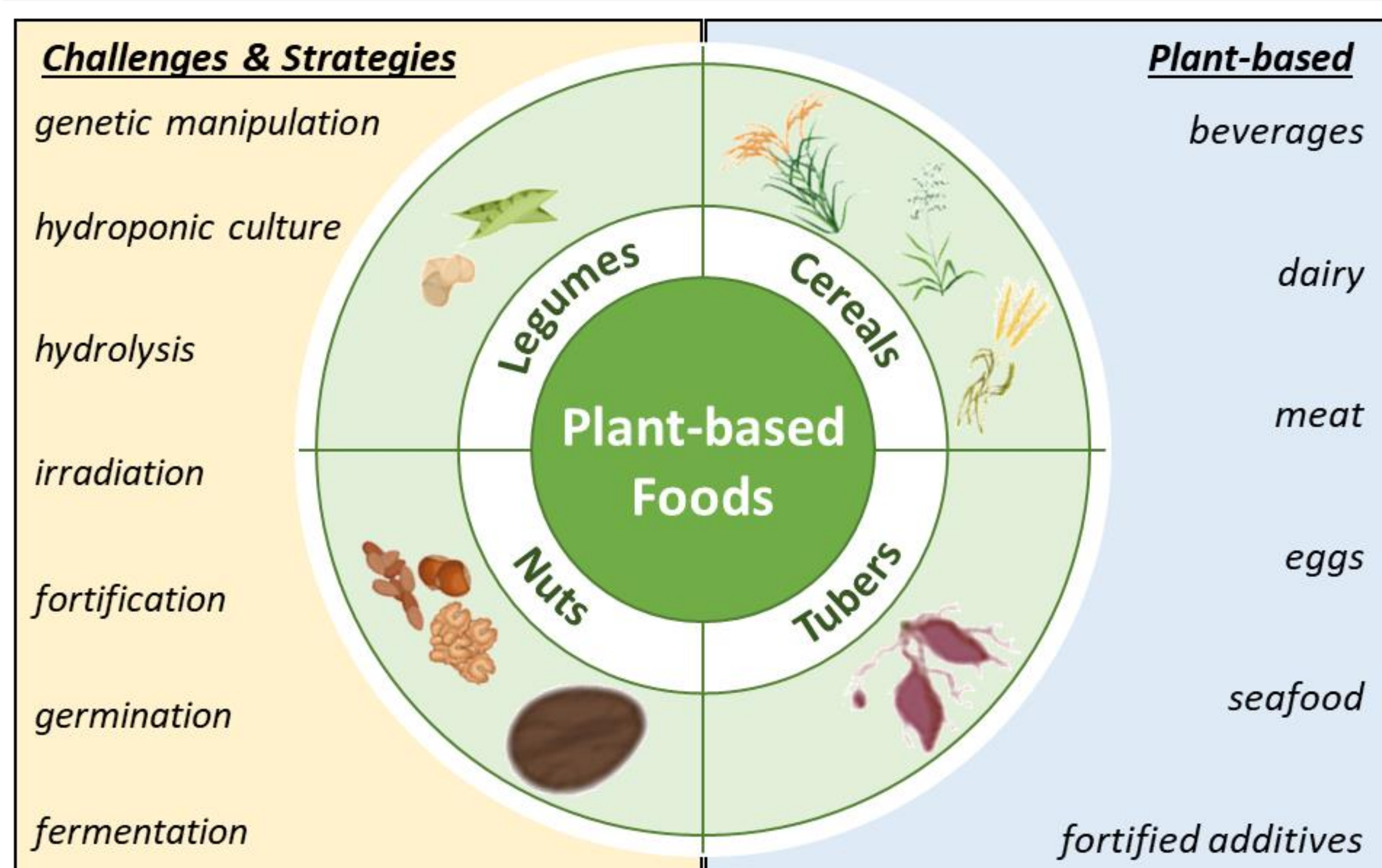
- 1) meet the **nutritional requirements** for a healthy diet;
- 2) be widely accepted by the consumers in terms of flavor and texture;
- 3) be produced in an environmental-friendly manner;
- 4) be the least possible industrially manipulated [5].

Several plant bases can be used based on their specific characteristics, nutritional, proximate composition (**Figure 1**) and sensorial advantages, and possible applications. They are currently employed as substituents of animal-based products and can be grouped mainly into four distinct groups: **cereals**, **legumes**, **nuts**, and **tubers**. In particular, **cereal grains are a major constituent of human diets around the world**.

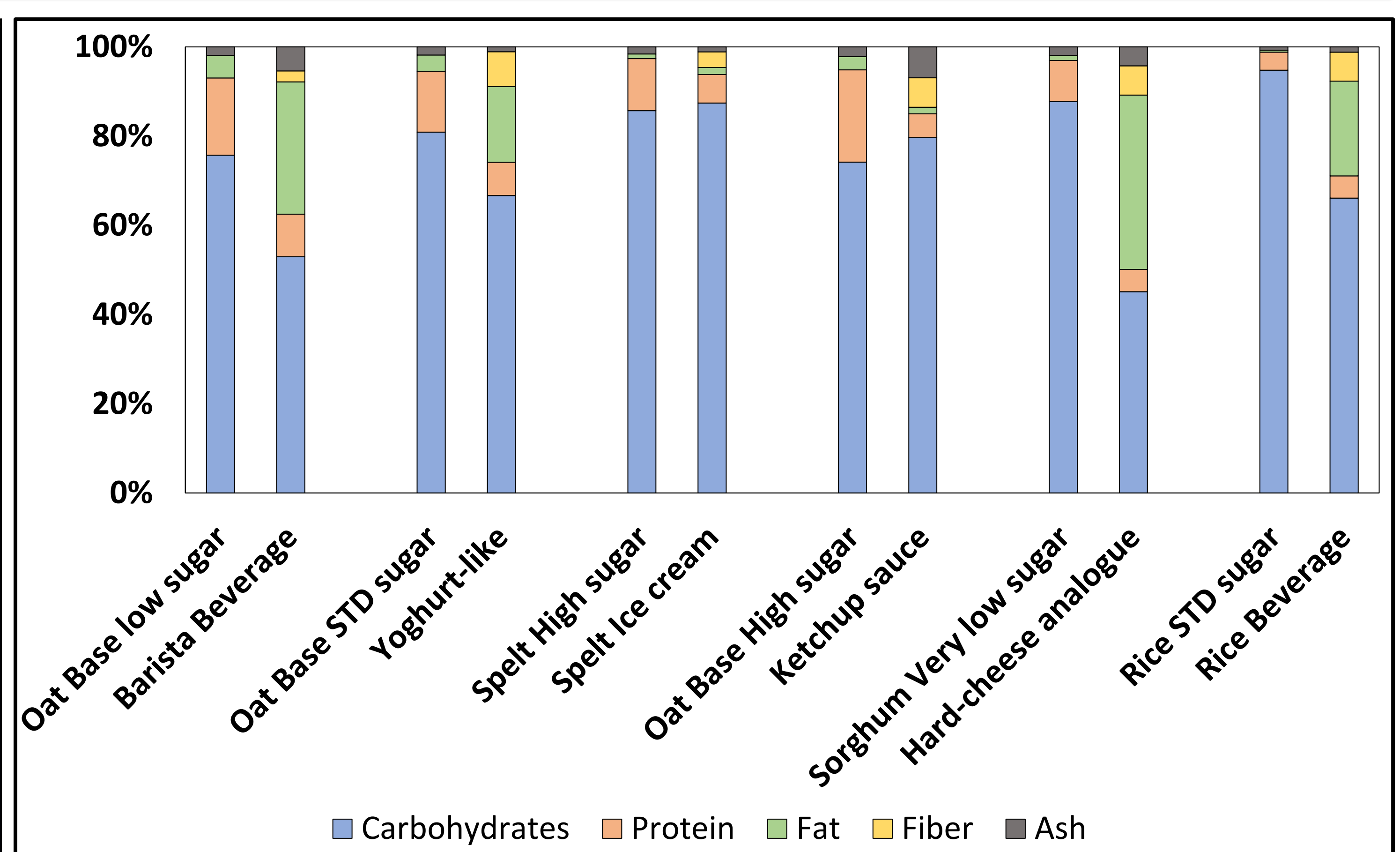
The consumption of cereal-based food – mainly whole grain cereals – has been associated with ameliorated conditions in certain diseases, including **type 2 diabetes**, **cardiovascular diseases** and certain types of **cancer** [6], [7].



## Findings



**Figure 2.** The use of **cereals**, **legumes**, **nuts**, and **tubers** as plant bases: the main **technological challenges** and **innovative strategies** involved in their processing and the most common **food applications** currently in the market.



**Figure 3.** Proximate composition of the **plant-based concentrates** and respective final **prototypes** developed in this project, using **different cereals** and **formulations**; prototypes were well accepted in a panel sensory test.

## Conclusion

- **Different plant bases** can be **combined** to achieve the **best nutritional profiles** and **textures**.
- Several strategies must be employed, using a **combination of old and new methodologies** for the **(re)formulation of products**.
- Achieving the **right balance between nutritional and quality modification** is challenging.
- Further research is required to **optimize plant-based products** to achieve **balanced diets**, while **minimizing environmental impacts**.

## References

- [1] M. Estell, et al, *Sustainability*, **2021**, doi: 10.3390/SU13031478.
- [2] A. Alcorta, et al, *Foods*, **2021**, doi: 10.3390/FOODS10020293.
- [3] E. Beacom, et al, *J. Food Prod. Mark.*, **2021**, doi: 10.1080/10454446.2021.1955799.
- [4] K. Papier et al, *BMC Med.*, **2021**, doi: 10.1186/S12916-021-01922-9/FIGURES/4.
- [5] Food and Agriculture Organization of the United Nations, "Plates, pyramids, and planets: developments in national healthy and sustainable dietary guidelines" 2016.
- [6] J. Montonen, et al, *Am. J. Clin. Nutr.*, **2003**, doi: 10.1093/AJCN/77.3.622.
- [7] E. Revilla et al, *Food Res. Int.*, **2009**, doi: 10.1016/J.FOODRES.2009.01.010.

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