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Editorial: Sustainable processing and preservation of underutilized indigenous foods

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Editorial on the Research Topic
Sustainable processing and preservation of underutilized indigenous foods

The nexus between sustainable food security, nutrition, food safety, processing, and preservation is largely unexplored. While limited progress is being made in the production sector globally, underutilized foods abound under different nomenclatures (orphan crops, forgotten foods, abandoned, underdeveloped, minor, neglected, or lost crops). Food systems influence dietary outcomes and have social, economic, and environmental impacts. Several indigenous foods are no longer part of contemporary diets, representing an erosion of biocultural heritage. Appropriate methods of cultivation, processing, preservation, and preparation are required for a nutritious safe and healthy diet. Foods that require research attention abound in different parts of the world.

Processing to promote food safety and consumer acceptability is an important aspect of food security. Wang et al. observed that 0.2 mL/L Citronelleal (CA) treatment enhanced food safety by reducing the pathogen load (especially molds) of freshly cut *Colocasia esculenta* slices, and prevented browning reactions that reduce the consumer acceptability of the product. Citronelleal could have caused pathogen membrane damage by inhibiting the biosynthesis of ergosterol, an important component of the membrane. Other natural inhibitors of enzymic browning are 4-hexylresorcinol that inhibited polyphenol oxidase activity, preventing the browning of fresh-cut pears (Li et al., 2017) and ascorbic acid that prevented the oxidation of fresh-cut apples (Worarad et al., 2021). The *de novo* biosynthesis of phenolics induced by cutting and peeling through the phenylpropanoid pathway could be related to the browning of several fresh-cut foods including taros (Xiao et al., 2022).

Processing can be used to improve nutritional quality. Processing of local nutritious food crops into ready to eat foods enhance utilization and convenience and provide feedback for improved production of the crop. Food processing unit operations are used to achieve the desired changes in the raw materials. Edima-Nyah et al. produced acceptable snack bars, from blended flours of underutilized cereals and legumes. Such food products have extended shelf-life, reduced anti-nutrients, and diversified diets. When local food crops are used to produce convenience foods such as snack bars, nutrient fortified food products are

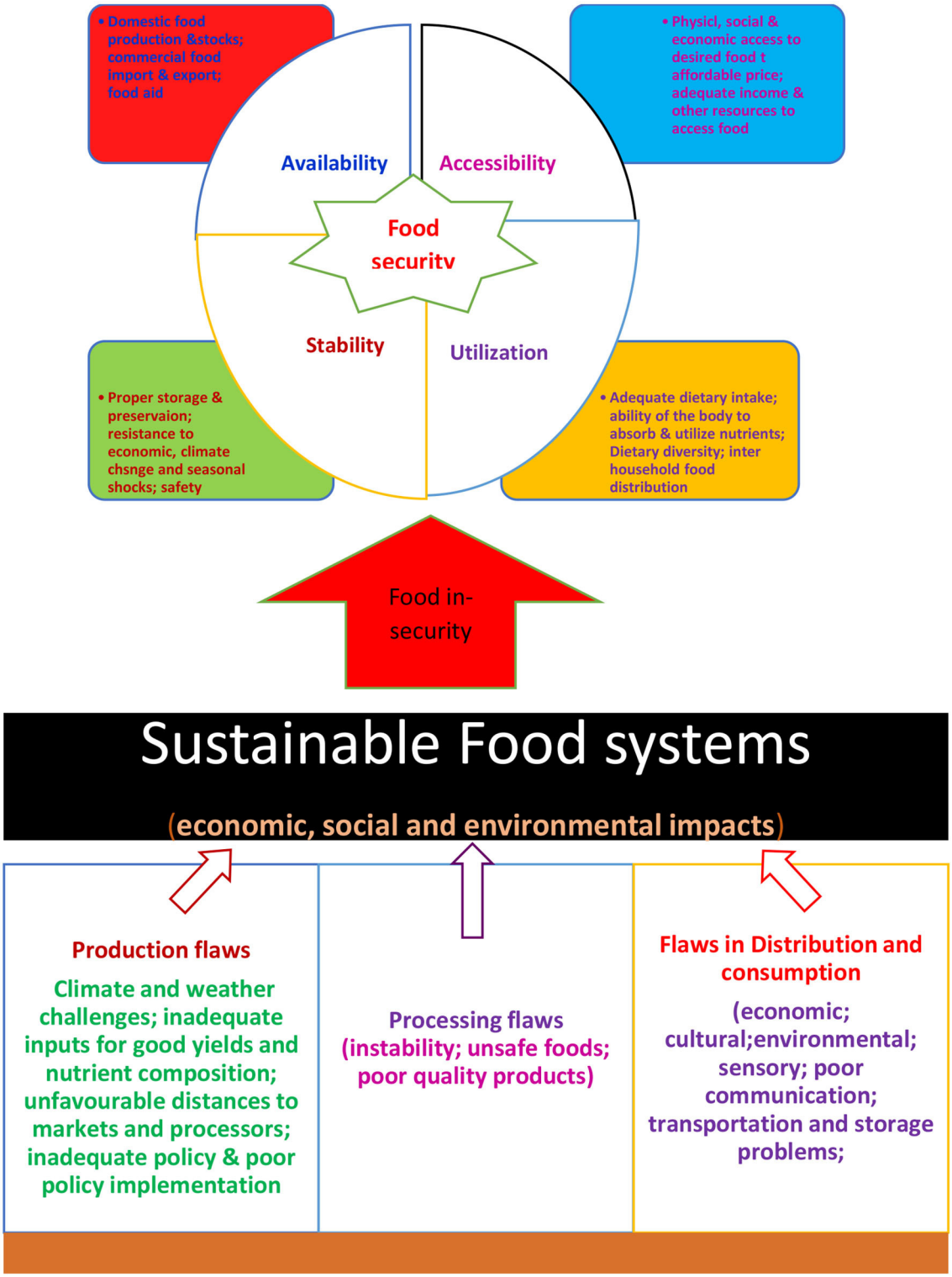

FIGURE 1
Flaws in production, processing, distribution, and consumption make food systems unsustainable and promote food insecurity.

developed, sensory acceptability and convenience are improved, importation and foreign exchange are reduced.

Creation of awareness, documentation of forgotten food products and processes that require upgrading for improved food and nutrition security is important for sustainability of food systems. Traditional food products are disappearing from the local foodscapes due to social and ecological changes that affect their production. Documentation of local knowledge, about them will help to recover cultural heritage and promote food security (Herrera Cano and Suárez, 2020). Some fermented foods are part

of the social and cultural heritage of the populace which give identity to communities (Albuquerque et al., 2021; Ojeda-Linares et al., 2022). Research into their production methods, preparation tools, consumption patterns, etc will contribute to the revival of lost traditional practices and upgradement of processing methods (Flachs and Orkin, 2019; Herrera Cano and Suárez, 2020; Kraus et al., 2022). Different substrates may be used to produce traditional foods. The fermented products of the Tehuacán-Cuicatlán Valley, Mexico have maintained major products made from agave plants—such as pulque and mescal—and has promoted the incorporation of other species as *Schinus mole*. The knowledge of the possible substrates has not been passed to the newer generations, thereby constraining consistency and sustainability in the production of these complex food products. Tolonche (from this region) was a beverage that contributed to regional pride and cultural identity. On the other hand, production of Lapo from the same region is almost lost, due to impaired sugar cane production (Ojeda-Linares et al.).

Cost effective sustainable food processing (of both conventional and neglected food sources) could be used to enhance economic value and quality of foods. Industrial manufacture of chocolate face challenges of poor-quality raw materials, non-standardized processing methods, poor utilization of the by-products of processing (Cilas and Bastide, 2020; Goya et al., 2022). Improvement methods such as (a) pulp reduction, (b) addition of enzymes during fermentation (c) optimizing the activities of intracellular enzymes during the natural fermentation of cocoa seeds (d) use of inocula, are being complemented by methods suitable for chocolate production in developing countries, where box fermentation could be combined with controlled solar drying to produce good quality chocolate (González-Ríos et al., 2019; Obinze et al.).

Innovative processing can be used to improve health benefits. Modern processing techniques like ultrasonic extraction procedures could be used to isolate beneficial phytochemicals for improved health benefits. Natural antioxidants (e.g., anthocyanins) may be extracted from plants using modern technologies (Dong et al.). These natural antioxidants slow down the aging process and reduce the incidence of various diseases, like diabetes, cancer, coronary heart disease and Alzheimer's disease (Boengler et al., 2017; Pomatto and Davies, 2018; Viña et al., 2018).

Making food security sustainable requires improved production, harnessing both conventional and neglected products, and diversifying diets for good health and wellbeing. While biotechnological improvements are being made to accelerate food production, foods that were used in the past should not be overlooked. As a result of changes in cultural values, lifestyles, urbanization, environmental changes, some crops have been devalued as potential food sources. Crops with cumbersome processing methods may be disadvantaged even if they are nutritious.

Product development to meet special needs such as gluten free pasta for sensitive individuals is feasible (Dziki, 2021) from non-wheat sources, though the viscosity and elasticity of the dough may differ from those made from wheat (Lorenzo et al., 2018). Water binding agents, thickeners, gums, and flavors may be added to quinoa flour to obtain gluten-free long extruded pasta comparable to those from wheat products (Córdoba-Cerón et al.).

A sustainable food system delivers food security and nutrition without compromising economic, social, and environmental factors. It is the heartbeat of the United Nations Sustainable development goals. The global food system requires re-organization for improved production, economic processing and preservation, social inclusivity of marginalized populations and environmental sustainability to achieve food security (See Figure 1).

The six articles in this Research Topic will help the readers understand the roles of production, processing, distribution and the link between food systems and food security. Promoting efficient food systems accelerates sustainable food security.

Author contributions

PO: Conceptualization and Writing—original draft. PL-O: Writing—review and editing. DB: Writing—review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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