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Review Article

Plant Based Legume Extracts as Milk Alternatives - A Review

Aditi Garg[1, *], Sheel Sharma[1], Preeti Verma[2]

[1]Food Science and Nutrition, Department of Home Science, Banasthali Vidyapith, Jaipur, India

[2]Home Science, Krishi Vigyan Kendra, Banasthali Vidyapith, Jaipur, India

Abstract

Animal based milk and its products have been the most important part of dairy consumption, but then demand has steadily outpaced the consumption since the mid-20th century especially in the last decade. This shift has coincided with a growing consumer preference for vegetative origin milk alternatives, which increasingly come from soy, legumes, nuts, seeds, and grains. This review is focused on the potential of plant-based milk alternatives, including soymilk, chickpea milk, kidney bean milk and cowpea milk as sustainable, nutritious, and functional substitutes for traditional dairy milk. Recent findings highlight advancements in processing methods such as heat treatment, fermentation, and germination, which mitigate anti-nutritional factors, enhance flavor profiles, and improving sensory and nutritional qualities. Emerging legume-based options, beyond the widely consumed soymilk, appear promising to for diversify the-se alternative plant-based milk resources owing to their superior protein quality, bioactive compounds, and environmental benefits. This review also underscores the sustainability of legumes, highlighting their contributions to soil health, nitrogen fixation living little carbon footprints compared to dairy milk and its products. This review affirms that legume-based milk alternatives offer a viable, sustainable solution to global challenges in food and nutrition security and environmental health apart from providing healthier options for lactose-intolerant and saturated fat consumption conscious consumers.

Keywords

Plant Based Legume Extracts, Plant-Based Milk Alternatives, Legume-based Milk Alternatives, Food Security, Environmental Health, Lactose-intolerant

1. Introduction

Milk is one single food that is considered almost complete for all ages and can partake this food, either as milk as it is, or its products. Traditionally milk is produced from farm animals like cow, buffalo, goat, camel and sheep, often known as dairy milk. It goes to make the largest component of dairy consumption, content wise. Consumption of "dairy milk and its products" contributes to satisfy optimum nutrient requirements and, by and large, considered a complete food providing nourishment and eliminating diseases [1, 2]. Overall, consumption of milk was mostly associated with benefits than harm to a series of health-related outcomes for human health [3]. However, dairy milk has high cost effects (high cost of animal-based food sources) and, more often than not, its supply becomes insufficient to meet the nutritional demand of masses.

*Corresponding author: agarg6983@gmail.com (Aditi Garg)

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However, it is nutritionally deficient in iron and vitamin C and contains saturated fat. Besides, its over consumption has been seen to cause degenerative diseases [4]. However, consumer demand is slowly shifting towards healthier alternatives like cheese, yoghurt as well as plant based alternatives, mostly derived from soya, nuts, legumes, seeds and grains [5, 6]. Such a shift in inclination towards partaking dairy milk alternatives are due to the emergence of enlightened populations, intensity of vegan waves and food ecosystem [7, 8]. The "plant based" milk market is expected to be worth between $20.1 billion and $31.1 billion in 2024. The need for the milk alternatives is growing by leaps and bounds, expected to increase by 4% in the next 6-9 years i.e. 2030 to 2033 [9].

As mentioned earlier, the demand for plant based milk as traditional milk substitute has also increased due to steep rise in population. Studies have shown that lactose intolerant population chooses "plant based" dairy-milk alternatives, promoting the need of "plant based" milk [10-12]. These constraints have motivated food scientists to look for plant based milk (PBM) substitutes.

This change in scenario has gone to raise the production of vegetative origin milk like soy-milk, oat-milk, nut-milk and many others, in a bid to utilize all plant based food resources due to their nourishing ability [13-16]. PBM is water soluble extract based on legumes, nuts, cereals, millets or vegetables. These products are potential career of viable lactic acid bacteria and probiotics in the diet for maintaining gut health [17, 18]. The sources from which PBMs can be obtained are numerous and are in continuous development offering valuable options to human health [19].

Additionally, PBM products are resource and leave little carbon foot prints as compared to traditional milk [20]. On the other hand, raising animals for milk production has environmental issues in terms of their fodder consumption and methane producing excretory material, thus the constant production and consumption of dairy products is consistently degrading the environment. The consumption of red meat and other foods of animal origin like dairy milk create an unsustainable pressure on the environment [21]. PBMs have a substantially lower environmental footprint to that of animal based dairy milk. For instance, legume extract milk is most suited as a nutritious choice, since they are rich in proteins and other health enhancing substances. When legumes replace dairy products, the diet transition not only improves human health but also ensures a healthy environment [22, 23]. Thus, utilizing plant based resources for the production of dairy milk substitutes also helps in achieving targets to limit agents of climate change of the Paris Agreement (UNFCCC 2024) [24]. Plant-based diet with potential significance reduces t environmental footprint of diet [25]. Additionally, this also contributes to creating a roadmap for consumers, to motivate them to arrange their diets wisely, taking into consideration both the "health and environmental sustainability" aspects [26].

Amongst all the plant resources, legumes are seen as important alternatives because of immense varietal diversity and ease of cultivation in different terrains and soils [27]. Legumes are climate-smart crops and can serve as environment sustaining agents [28, 29]. Therefore, the increased production of legumes covering more land area would heighten the soil fertility, reducing moisture and nutrient stress, because of the nitrogen fixing ability of their root nodules, thus imparting sustainability to the depleting soil. It also augments crop diversity in modern cropping system and reduces the use of external inputs [30-32]. Legumes also perform well in soil conservation system as their intercropping release "high quality" organic matter in the soil to facilitate nutrient circulation and water retention, thereby improving soil fidelity [33-35]. All these facts have increased the interest of scientists in plant based foods like legumes taking them for healthier and agriculturally sustainable alternatives [36].

On the same line, legumes are the second most notable source of human food after the cereal family. These make up a significant proportion of calories and proteins in diet around the world [37]. These proteins from legume seeds have potential applications as natural antioxidants, functional foods, and therapeutics for boosting human health [38, 39]. Nevertheless, they have remained orphans or underutilized because of various use and supply constraints. They need to be accorded a limited economic significance in the global market as they adapt better to extreme climatic and soil conditions with high tolerance to abiotic environmental stresses such as draught that can augment income of resource-poor farmers as well [40].

Legume extracts, seen as cow's milk alternatives, are gaining popularity around the world. These are produced from the disintegration of plant material, extraction in water, and subsequent homogenization [41, 42]. Due to somewhat similar chemical composition, they can be utilised as substitutes or replacers of cow's milk for direct usage or as blends in some dairy based preparations [43]. In this way, they serve as more affordable, convenient, sustainable, nutritious and tasty options [44, 45]. Legume extraction does not require any specialized and sophisticated equipment [46]. Legume extract is produced by hydrating the legumes by soaking, removing excess water, and blanching the hydrated legumes in the presence of water and sodium bicarbonate, dehulling and grinding to form a slurry which can then be filtered to remove insoluble fiber and suspended soluble fiber, producing a "non-dairy milk" [47, 48].

Legume extracts seem to present the most balanced combination of nutrients, the protein content similar to cow's milk, lack lactose and have low saturated fat content [4, 49]. Especially the protein and fat are excellent as compared to standard milk, while iron and vitamin C are found to be higher in them [50, 51]. Additionally, these drinks can become a very good alternative to cow's milk to supplement the human diets with magnesium, copper, manganese, or zinc [52, 53].

The nutrient content of plant milk alternative has been attempted to align with that of cow's milk. For this, several

approaches are used such as the use of additives to be added to legume extracts through using different processing strategies during the preparation process and through the application of innovative ideas [54]. Expectations of present consumers for healthier and more palatable foods have driven the dairy industry to expand their knowledge beyond traditional milk products for the production of various "plant based" non-conventional beverages with health benefits equating conventional milk [55]. Thus, consumption of legume protein in legume extract milk as alternative to dairy milk had benefitted human health and this would surely increase consumers' attention towards legume milk as a more sustainable diet [56, 57].

For some people, legumes might have made only a minor part of human diet in terms of both quality and quantity. But, they are agriculturally important crop, appreciated for its high protein content among households with low-income, or where people abstain from eating meat for religious or ethical reasons [31]. Suffice to say, legumes are an economical source of plant-based proteins as compared to animal-based proteins [58]. In fact, the precise processing technologies for preparing legume-based milk substitutes make it possible to keep with a relevant consumer choice [59]. Additionally, the digestibility of protein in legumes also increases after processing by different simple methods like soaking, pressure cooking and many others [60]. In terms of organoleptic properties, legumes can also mimic the texture and taste of their natural meat counterparts as also mimic for the high protein content of meat [61].

Legume extracts, as one of the most important milk alternatives, had additional attributes in being lactose and cholesterol free, qualifying well for the category of healthy food products. Therefore, the composition of legumes have gained popularity among health conscious consumers, with gluten intolerance as well as those concerned with managing weight [62]. Being a good alternative to animal protein for those who have limited resources, legumes have become a poor man's meat and medicine [63]. Apart from their nutritional potential, legumes also have medicinal effect on human body in being potentially hypocholestremic and non-communicable and degenerative diseases, like atherosclerosis, cancer and inflammatory diseases prevention [64-67]. These are abundant in resistant starch and dietary fibre whose consumption shows many health benefits against a range of disorders including obesity, overweight, type II diabetes and colon cancer. Legume starches had low predicted glycemic index helping diabetic patients [68].

Legumes also contain "bioactive compounds" such as saponins, flavonoids, lectins, phytic acid, tannins and the like. Most of the "bioactive compounds" possess antioxidant functions, which play important role in the prevention of some cancers, bone related diseases, heart disorders, and many degenerative diseases [69, 70]. Legume based beverages shows significant antioxidant activity, indicating them as functional beverages with free-radical scavenging properties [71]. Additionally, legumes also contain enzyme inhibitors like α-glycosidase, α-amylase and neurotransmitters like gamma-amino butyric acid (GABA) which have nutraceutical properties. In all, legume seeds are also considered as potential neutraceutical, disease preventive agents [72].

There is a need for further product development based on legume milk at both household level and for commercial purposes to ensure food security. This, in turn, will boost the production and usage of legumes, thereby making them popular among consumers. Popularizing legume will increase its production and utilization [73]. Despite legumes containing valuable nutrients and having great potentials, some of legume proteins are indigestible due to their interaction with components such as phytate and polyphenols [74, 75].

Furthermore, flavour and taste mark a key impact on consumer selection of "plant based" milk alternatives. In addition, attributes such as the appearance, nutrient content and environmental cost of PBM, alongside consumers' consciousness on environment and health significantly influence their preference and willingness to pay for PBM [76]. Suffice to say, consumers with high environmental awareness are more likely to appreciate and adapt PBM. Similarly, consumers with high health consciousness tend to value the environmental benefits of PBM and prioritize purchasing as it aligns with their health-conscious lifestyle and leading to a higher willingness to pay for PBM [77, 43].

Interestingly, the natural "plant based" milks have only limited acceptance due to beany and grassy notes which people perceived as "off flavour", while buttery, fruity and cheesy notes which people prefers are missing [78]. Thus, the potential of legume milk is often compromised by their undesirable off-flavour and taste despite their high protein content, low glycemic index and exceptional versatility [79, 80].

Despite all these benefits, legume beverages are restricted by processing and preservation barriers such as nutritional imbalances, antinutritional factors, protein allergies, undesirable flavors, emulsion stability issues, taste, availability, convenience, causing flatulence. Almost all edible legume seeds sources contain a plethora of anti-nutritional factors such as lectins, lipoxygenase, phyto-oestrogens, phytate, urease, oligosaccharides and protease inhibitors [81]. Processing challenges of these beverages are particularly seen in antinutrient and mineral composition, colloidal stability, flavour, microbial and chemical shelf life [82, 83]. The problem of preservation can be sorted by consuming the freshly prepared legume milk. Heat treatment, such as cooking and pasteurization, are able to remove off-flavours [84].

Heat treatment is a significant factor in the palatability of the milk produced. A study by Maria & Victoria (2018) concludes the milk produced from almond kernels without any pretreatment has inferior flavor [85]. Therefore, heat treatment of almond nut and its produced milk both affect the organoleptic and nutritional quality of the produced milk in complementary manner. Fermentation has also been seen to improve sensory characteristics of many innovative legume

based beverages [86]. Some of the popular legume extracts being used either as such or as blends with milk are described further in this review paper.

1.1. Soymilk-At the Vanguard of Legume Milks

Soymilk is the most consumed and the only legume milk available in the market. It is one prominent legume extract that serves as a low-cost non-dairy alternative with highest protein content compared to cereals and others legumes species [87]. It contains atleast half the fat and double the content of folate and Vitamin B12 than that present in cow's milk [88]. Dehulled soybean milk is more nutritious as compared to whole soybean milk [89].

Soybean is the most economically significant legume providing a major source of plant protein globally for millions of consumers as it is cost effective, high quality, and high protein for "plant based" meat alternatives [90]. Additionally, it is rich in soluble and insoluble dietary fibre and isoflavones whose presence is important in regular diet as antioxidant [91, 92]. These isoflavones also acts as phytoestrogen which increase feminity thus, must be consumed in recommended dosage [93].

Soy protein avoids the inconvenience of the lactose and gluten intolerance. It contains no cholesterol and is low in saturated fats. It is also used in increasing total protein content and improving the essential amino acid profile. It contains 9 amino acids including leucine, isoleucine, valine, lysine and arginine. As a matter of fact, these elements are very important for creating the conditions necessary for muscle gain. The consumption of soybean has been limited, mainly due to beany flavor and soy allergy, and thus not considered agreeable by the majority of consumers [94]. Germination can minimize beany flavor, increase phytochemical compounds, and functional properties [95].

There are other constraints that point towards other legumes for making milk in the future market. Thus, there are limitations in legumes for being used as plant based milk i.e. the presence of antinutritional factors [65, 96]. Effective processing helps to reduce these antinutritional factors present in legume based products before consumption [97]. The antinutritional factors in soya bean are denatured or decreased by traditional processing methods like dehulling, heating, soaking, boiling, pressure cooking, roasting, germination, sprouting and fermentation without much difficulty [98-100].

1.2. Chickpea (Cicer Arietinum)

Chickpea, also called garbanzo beans or bengal gram, is nutrient-dense food. It is one of the most economic food legumes of this family. Chickpea can be a promising substitute in the development of "plant based" [101]. This is a plant-based, consumer accepted legume that can be used to develop a novel plant-based milk alternative. It provides rich content of protein, dietary fiber, carbohydrate, micronutrients and potentially health-beneficial phytochemicals [102]. Its protein quality and nutritional value is considered to be better than other pulses making it much sought after. In the semi-arid tropics, chickpea is a significant part in diets of vegetarian people, or who can't afford animal proteins [103].

The significance and utilization of chickpea for several health ailments have been mentioned in ancient manuscripts and the ayurvedic system of medicine [104]. Chickpea has phytochemicals such as isoflavones and saponins which have potential benefits against metabolic syndrome and type II diabetes [105]. It makes an excellent replacement for meat in many vegetarian and vegan dishes. It also delivers benefits to farming systems that range from a smaller carbon footprint due to biological nitrogen fixation to improving soil health [106]. The antimicrobial property of chickpea can lead to the development of naturally preserved food stuffs from it. Wide spectrums of protein and peptides in raw chickpeas and processed extracts have exerted antimicrobial activity against food borne pathogens when applied in the range of 8 to 64 microgram per litre [107].

Chickpea extract milk blended with 10% or 30% of coconut milk have been prepared which has a rich nutritional composition to that of cow's milk and other alternatives for cow's milk such as oat, rice and almond milk [22, 108]. The potential of substitutes for animal based cheese in the form of lentil milk as a suitable ingredient for plant-based soft cheese production offers a new nutritious option for consumers with dietary preferences or restrictions [109].

1.3. Kidney Bean (Phaseolus Vulgaris)

Kidney bean is the widely produced and consumed bean globally. It has prime importance in human and animal nutrition [110]. It is affordable, healthy, has high protein (25-50%), complex carbohydrate (50%–60%) and is a rich source of fibre, vitamin, mineral, and PUFA (poly-unsaturated fatty acids) [111]. Kidney bean is an underutilized legume that might be used to develop a novel "plant based" milk alternative having its rich protein content and other diverse health benefits [112]. It can become a rich source of a variety of phytochemicals such as flavonoids, tannins and phytates. Though some of the non-nutrient phytochemicals reducing nutrient bio-availability yet the bargain is still tolerable as these phytochemicals are health enhancing in the long run [113].

The health benefits include reduction of the risks for aging-related diseases [114]. Fiber in kidney bean, moderates blood sugar levels and promotes colon health. Kidney bean can also become an excellent substitute for meat and dairy products, a fact which can help clearing the environment of methane generated by animal dung, in the long run of rearing animals in large run [115, 116]. In kidney bean, presence of some anti-nutritional factors; such as alpha-galactosides, trypsin and chymotrypsin inhibitors, phytates and lectins, hinder the availability of nutrients. Heat treatments involving

pressure cooking and roasting are household means to inactivate antinutritional factors [117].

1.4. Cowpea (Vigna Unguiculata)

Cowpea is a major produced crop for worldwide food and nutritional security [118]. It is also called black-eyed pea. It has "Good protein quality with a high nutritional value", nitrogen fixing capacity and ability for being drought resistant and heat tolerant. It is adaptable to different types of soil and intercropping systems. It is able to improve soil fertility, prevents erosion, the facts that make it an important economic crop in many developing regions [119].

It is plentiful source of not only food energy and protein, but also of minerals and vitamins, with a complementary amino acid pattern and a relatively low fat content as compared to cereals, making it a potentially substantial component in the human diet [120]. It has health enhancing properties, including antidiabetic, anticancer, antihyperlipidemic, antihypertensive and antiinflammatory ones. Cowpea has phenolic compounds with bioactive properties which may prevent the development of diseases like atherosclerosis and cancer [121].

1.5. Okara (Legume Milk Byproduct)

The residue obtained after extract formation is known as okara or legume milk byproduct (LMB). It contains high levels of nutrients such as protein, fibre and lipids, micronutrients and phytochemicals. It can be used in different household food preparations like in dough preparation for chapatti. At industrial level, on the production of alternative milks, the quantity of residue obtained is high as compared to the household level. The residue by product has caused environmental and financial issues for manufacturers. It has high moisture content, bioactive components and nutrients, and thus can be quickly degraded due to oxidative, enzymic and microbial activities [122]. However, a prudent channelization into various food products after heat treatment can turn okara into an edible asset.

2. Conclusions

Owing to the fact that they are treasure trove of nutrients, legumes are called- Nutritional Nuggets. After cereals, these are considered as the second most important source of food. They are valued worldwide as a sustainable and inexpensive meat substitute that benefit human health, environment and agriculture output. Legumes have potential to become the nutritional seed of sustainable future. They serve in place of the cheaper and healthier alternatives to animal foods, being rich in terms of quality and content of proteins and other nutrients.

Since legumes are nutritionally dense foodstuffs, being rich in protein, energy, unsaturated fat and all important vitamins and minerals, including their extracts in the diet can solve the existential problem of human subsistence. Legume extracts can also improve heart health, weight management and reduce risk of NCDs, like coronary heart disease, type II diabetes and some cancers due to the presence of bioactive substances or phytochemicals.

This applied research emphasizing the usage of household adaptable processing needs to be extended to the common masses all over India as legumes are cultivated across all the status. Enabling rural households to prepare legume extracts making using them would go a long way in solving the problem of malnutrition and food accessibility. Same strategy can be adopted in other economically and nutritionally deprived countries across rest of the Asia and Africa.

The extracts prepared from legumes after appropriate processing steps and their blending with bovine milk could offer an easy way out for a nourishment option with favourable availability and economy and higher nutrition and health care options than those of milk. The illuminating aspects of such foodstuff improvisation are nutritional enrichment and health augmentation, complemented and supplemented through both plant and animal sources. This can also go a long way in providing a Philip to cultivation; production and consumption of legumes that are hitherto look down upon as non-conventional food stuffs.

Abbreviations

PBM	Plant Based Milk
GABA	Gamma-Amino Butyric Acid
PUFA	Poly-Unsaturated Fatty Acids
NCDs	Non-Communicable Diseases
LMB	Legume Milk Byproduct

Author Contributions

Aditi Garg: Conceptualization, Writing – original draft, Resources, Writing – review & editing

Sheel Sharma: Writing – review & editing, Supervision, Validation, Visualization

Preeti Verma: Writing – review & editing, Supervision, Validation, Visualization

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Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Thorning, T. K., Raben, A., Tholstrup, T., Soedamah-Muthu, S. S., Givens, I. and Astrup, A., 2016. Milk and dairy products: Good or bad for human health? An assessment of the totality of scientific evidence. Food & Nutrition Research, 60, pp. 1-11.

[2] Chaturvedi, S & Chakraborty, S 2021, 'Review on potential non-dairy synbiotic beverages: A preliminary approach using legumes', International Journal of Food Science & Technology, vol. 56, no. 5, pp. 2068–2077.

[3] Zhang, X., Chen, X., Xu, Y., Yang, J., Du, L., Li, K. and Zhou, Y., 2021. Milk consumption and multiple health outcomes: Umbrella review of systematic reviews and meta-analyses in humans. Nutrition & Metabolism, 18, pp. 1-7.

[4] Paul, A. A., Kumar, S., Kumar, V. and Sharma, R., 2019. Milk analog: Plant-based alternatives to conventional milk, production, potential and health concerns. Critical Reviews in Food Science and Nutrition, 60(18).

[5] Stewart, H., Kuchler, F., Dong, D. and Cessna, J., 2022. Examining the decline in U.S. per capita consumption of fluid cow's milk, 2003–18. U.S. Department of Agriculture Economic Research Service. Available online: https://www.ers.usda.gov/webdocs/publications/102447/err-300.pdf?v=9125 (accessed on 27 October 2022).

[6] Mylan, J., Morris, C., Beech, E. and Geels, F. W., 2019. Rage against the regime: Niche-regime interactions in the societal embedding of plant-based milk. Environmental Innovation and Societal Transitions, 31, pp. 233-247.

[7] Mefleh, M., Pasqualone, A., Caponio, F. and Faccia, M., 2022. Legumes as basic ingredients in the production of dairy-free cheese alternatives: A review. Journal of the Science of Food and Agriculture, 102(1), pp. 8-18. https://doi.org/10.1002/jsfa.11502

[8] Stewart, H., Kuchler, F. and Cessna, J., 2020. Are plant-based analogues replacing cow's milk in the American diet? Journal of Agricultural and Applied Economics, 52(4), pp. 562-579.

[9] Grand View Research, 2024. Plant-based milk market size, share & trends analysis report by product (almond milk, oat milk, soy milk, coconut milk), by nature (organic, conventional), by flavor (flavored, non-flavored), by distribution channel, by region, and segment forecasts, 2024–2030. Available from: https://www.grandviewresearch.com/industry-analysis/plant-based-milk-market-report

[10] Hartati, F. K., 2022. Utilization of jackfruit (Artocarpus heterophyllus) seeds as raw material for vegetable milk. International Journal of Current Science Research and Review, 5(08), pp. 3134–3140.

[11] Bridges, M 2018, 'Moo-ove over, cow's milk: The rise of plant-based dairy alternatives', Practical Gastroenterology, vol. 42, no. 1, pp. 20–27.

[12] Chalupa-Krebzdak, S, Long, CJ & Bohrer, BM 2018, 'Nutrient density and nutritional value of milk and plant-based milk alternatives', International Dairy Journal, vol. 87, pp. 84–92. https://doi.org/10.1016/j.idairyj.2018.07.018

[13] Naziri, E., Koupantsis, T., Mantzouridou, F. T., Paraskevopoulou, A., Tsimidou, M. Z. and Kiosseoglou, V., 2017. Influence of thermal treatment on the stability of vegetable "milk" obtained by ultrafiltration of aqueous oil body extracts from various sources. European Journal of Lipid Science and Technology, 119(7), p. 1600362.

[14] Romulo, A., 2022. Nutritional contents and processing of plant-based milk: A review. In: IOP Conference Series: Earth and Environmental Science, 998(1), p. 012054. IOP Publishing.

[15] Ismail, M. M., 2015. Which is better for humans, animal milk or vegetable milk. Journal of Nutrition Health & Food Engineering, 2(5), pp. 14-15.

[16] Lang, M., 2020. Consumer acceptance of blending plant-based ingredients into traditional meat-based foods: Evidence from the meat-mushroom blend. Food Quality and Preference, 79, p. 103758. https://doi.org/10.1016/j.foodqual.2019.103758

[17] Pontonio, E., Montemurro, M., Dingeo, C., Rotolo, M., Centrone, D., Carofiglio, V. E. and Rizzello, C. G., 2022. Design and characterization of a plant-based ice cream obtained from a cereal/legume yogurt-like. LWT - Food Science and Technology, 161, p. 113327.

[18] Walsh, K., Kiosa, A., Olupot-Olupot, P., Alaroker, F., Okiror, W. and Nakuya, M. et al., 2024. Legume-supplemented feed for children hospitalised with severe malnutrition: A phase II trial. British Journal of Nutrition, pp. 1–10. https://doi.org/10.1017/S0007114524000837

[19] Plamada, D.; Teleky, B.-E.; Nemes, S. A.; Mitrea, L.; Szabo, K.; C˘ alinoiu, L.-F.; Pascuta, M. S.; Varvara, R.-A.; Ciont, C.; Mart˘ au, G. A.; et al. Plant-Based Dairy Alternatives—A Future Direction to the Milky Way. Foods 2023, 12, 1883. https://doi.org/10.3390/ foods12091883

[20] Craig, W. J., Messina, V., Rowland, I., Frankowska, A., Bradbury, J., Smetana, S. and Medici, E., 2023. Plant-based dairy alternatives contribute to a healthy and sustainable diet. Nutrients, 15(15), p. 3393.

[21] Penha, C. B., Santos, V. D. P., Speranza, P. and Kurozawa, L. E., 2021. Plant-based beverages: Ecofriendly technologies in the production process. Innovative Food Science & Emerging Technologies, p. 102760.

[22] Rincon, L., Botelho, R. B. and de Alencar, E. R., 2020. Development of novel plant-based milk based on chickpea and coconut. LWT - Food Science and Technology, 128, p. 109479.

[23] Vanga, S. K. and Raghavan, V., 2018. How well do plant-based alternatives fare nutritionally compared to cow's milk? Journal of Food Science and Technology, 55(1), pp. 10-20. https://doi.org/10.1007/s13197-017-2915-y

[24] Porto Costa, M., Saget, S., Zimmermann, B., Petig, E., Angenendt, E., Rees, R. M., Chadwick, D., Gibbons, J., Shrestha, S., Williams, M. and Styles, D., 2023. Environmental and land use consequences of replacing milk and beef with plant-based alternatives. Journal of Cleaner Production, 424, p. 138826.

[25] Góralska-Walczak, R., Kopczyńska, K., Kazimierczak, R., Stefanovic, L., Bieńko, M., Oczkowski, M. and Średnicka-Tober, D., 2024. Environmental indicators of vegan and vegetarian diets: A pilot study in a group of young adult female consumers in Poland. Sustainability, 16(1), p. 249.

[26] Kyriakopoulou, K., Keppler, J. K. and van der Goot, A. J., 2021. Functionality of ingredients and additives in plant-based meat analogues. Foods, 10, p. 600. https://doi.org/10.3390/foods10030600

[27] Froiio, F., Cristiano, M. C., Mancuso, A., Iannone, M. and Paolino, D., 2020. Vegetable-milk-based yogurt-like structure: Rheological properties influenced by gluten-free carob seed flour. Applied Sciences, 10(19), p. 6963.

[28] Popoola, J. O., Aworunse, O. S., Ojuederie, O. B., Adewale, B. D., Ajani, O. C., Oyatomi, O. A., Eruemulor, D. I., Adegboyega, T. T. and Obembe, O. O., 2022. The exploitation of orphan legumes for food, income, and nutrition security in Sub-Saharan Africa. Frontiers in Plant Science, 13, p. 782140. https://doi.org/10.3389/fpls.2022.782140

[29] Jimenez-Munoz, L. M., Tavares, G. M. and Corredig, M., 2021. Design future foods using plant protein blends for best nutritional and technological functionality. Trends in Food Science & Technology, 113, pp. 139-150. https://doi.org/10.1016/j.tifs.2021.04.049

[30] Foyer, C. H., Lam, H. M., Nguyen, H. T., Siddique, K. H., Varshney, R. K., Colmer, T. D., Cowling, W., Bramley, H., Mori, T. A., Hodgson, J. M. and Cooper, J. W., 2016. Neglecting legumes has compromised human health and sustainable food production. Nature Plants, 2. https://doi.org/10.1038/NPLANTS.2016.112

[31] Mousavi-Derazmahalleh, M., Bayer, P. E., Hane, J. K., Valliyodan, B., Nguyen, H. T., Nelson, M. N., Erskine, W., Varshney, R. K., Papa, R. and Edwards, D., 2019. Adapting legume crops to climate change using genomic approaches. Plant, Cell & Environment, 42(1). https://doi.org/10.1111/pce.13203

[32] Bekuzarova, SA, Kozyrev, AK, Shabanova, IA, Lushenko, GV & Weissfeld, LI 2020, 'Enhancing of nitrogen fixation by legumes', BIO Web of Conferences, vol. 23, p. 02006. https://doi.org/10.1051/bioconf/20202302006

[33] Cichońska, P & Ziarno, M 2021, 'Legumes and legume-based beverages fermented with lactic acid bacteria as a potential carrier of probiotics and prebiotics', Microorganisms, vol. 10, no. 1, p. 91.

[34] Layek, J., Das, A., Mitran, T., Nath, C., Meena, R. S., Yadav, G. S., Shivakumar, B. G., Kumar, S. and Lal, R., 2018. Cereal+ legume intercropping: An option for improving productivity and sustaining soil health. In: Legumes for Soil Health and Sustainable Management, Springer, pp. 347-386. https://doi.org/10.1007/978-981-13-0253-4_11

[35] Wang, T., Duan, Y., Lei, X., Cao, Y., Liu, L., Shang, X., Wang, M., Lv, C., Ma, Y., Fang, W. and Zhu, X., 2023. Tea plantation intercropping legume improves soil ecosystem multifunctionality and tea quality by regulating rare bacterial taxa. Agronomy, 13(4), p. 1110.

[36] Stagnari, F., Maggio, A., Galieni, A. and Pisante, M., 2017. Multiple benefits of legumes for agriculture sustainability: An overview. Chemical and Biological Technologies in Agriculture, 4, p. 2. https://doi.org/10.1186/s40538-016-0085-1

[37] Kakaei, M., Rehman, F. U. and Fazeli, F., 2024. The effect of chickpeas metabolites on human diseases and the application of their valuable nutritional compounds suitable for human consumption. Cellular, Molecular and Biomedical Reports, 4(1), pp. 30-42.

[38] Petchiammal, C. and Hopper, W. J. I., 2014. Antioxidant activity of proteins from fifteen varieties of legume seeds commonly consumed in India. International Journal of Pharmacy and Pharmaceutical Sciences, 6(1-2), pp. 476-479.

[39] Krupa H, Jana, A. H. and Patel, H. G., 2011. Synergy of dairy with non-dairy ingredients or product: A review. African Journal of Food Science, 5(16), pp. 817–832.

[40] Cullis, C. and Kunert, K. J., 2016. Unlocking the potential of orphan legumes. Journal of Experimental Botany, 68(8), pp. 1895–1903.

[41] Jeske, S., Zannini, E. and Arendt, E. K., 2018. Past, present and future: The strength of plant-based dairy substitutes based on gluten-free raw materials. Food Research International, 110, pp. 42-51. https://doi.org/10.1016/j.foodres.2017.03.045

[42] McHugh, T., 2018. How plant-based milks are processed. Food Technology, 72, pp. 63-64.

[43] Silva, A. R. A. D., Santelli, R. E., Braz, B. F., Silva, M. M. N., Melo, L., Lemes, A. C. and Ribeiro, B. D., 2024. A comparative study of dairy and non-dairy milk types: Development and characterization of customized plant-based milk options. Foods, 13(14), p. 2169.

[44] Yadav, D. N., Bansal, S., Jaiswal, A. K. and Singh, R., 2017. Plant-based dairy analogues: An emerging food. Agricultural Research & Technology: Open Access Journal, 10(2), pp. 1-4.

[45] McClements, D. J. and Grossmann, L., 2021. A brief review of the science behind the design of healthy and sustainable plant-based foods. NPJ Science of Food, 5(1), p. 17.

[46] Bakiya, P, Arrivukkarasan, S & Anhuradha, S 2019, 'Optimization and its characterization of legumes-based milk chocolate to enhance its folic acid content', Think India Journal, vol. 22, no. 10, pp. 1349–1354.

[47] Gugger, E. T., Galuska, P. and Tremaine, A., 2016. Legume-based dairy substitute and consumable food products incorporating same. Google Patents.

[48] Arya, A & Sharma, S 2021, 'Preparation of legume extract blends and okara from pinto beans (Phaseolus vulgaris) and bovine milk and improvising upon popular recipes using them', International Journal of Nutrition & Lifestyle, vol. 1, no. 3, pp. 132–143.

[49] Silva, A. R. and Silva, M. M., 2020. Health issues and technological aspects of plant-based alternative milk: A review. Food Research International, 131, p. 108972. https://doi.org/10.1016/j.foodres.2019.108972

[50] Bisla, G, Archana, PV & Sharma, S 2012, 'Development of ice creams from soybean milk & watermelon seeds milk and evaluation of their acceptability and nourishing potential', Advances in Applied Science Research, vol. 3, no. 1, pp. 371–376.

[51] Profeta, A., Baune, M. C., Smetana, S., Bornkessel, S., Broucke, K., Van Royen, G., Enneking, U., Weiss, J., Heinz, V., Hieke, S. and Terjung, N., 2021. Preferences of German consumers for meat products blended with plant-based proteins. Sustainability, 13, p. 650. https://doi.org/10.3390/su13020650

[52] Welna, M., Szymczycha-Madeja, A., Lesniewicz, A. and Pohl, P., 2024. The nutritional value of plant drink against bovine milk—analysis of the total concentrations and the bio-accessible fraction of elements in cow milk and plant-based beverages. Processes, 12(1), p. 231.

[53] Mäkinen, O. E., Wanhalinna, V., Zannini, E. and Arendt, E. K., 2016. Foods for special dietary needs: Non-dairy plant-based milk substitutes and fermented dairy-type products. Critical Reviews in Food Science and Nutrition, 56(3), pp. 339-349. https://doi.org/10.1080/10408398.2012.761950

[54] Siddiqui, S. A., Mehany, T., Schulte, H., Pandiselvam, R., Nagdalian, A. A., Golik, A. B., Shah, M. A., Shahbaz, H. M. and Maqsood, S., 2024. Plant-based milk – Thoughts of researchers and industries on what should be called as 'milk'. Food Reviews International, 40(6), pp. 1703-1730.

[55] Grant, C. A. and Hicks, A. L., 2018. Comparative life cycle assessment of milk and plant-based alternatives. Environmental Engineering Science, 35(11), pp. 1235–1247. https://doi.org/10.1089/ees.2018.0233

[56] Molfetta, M.; Morais, E. G.; Barreira, L.; Bruno, G. L.; Porcelli, F.; Dugat-Bony, E.; Bonnarme, P.; Minervini, F. Protein Sources Alternative to Meat: State of the Art and Involvement of Fermentation. Foods 2022, 11, 2065. https://doi.org/10.3390/foods11142065

[57] Profeta, A., Baune, M. C., Smetana, S., Broucke, K., Van Royen, G., Weiss, J., Hieke, S., Heinz, V. and Terjung, N., 2021. Consumer preferences for meat blended with plant proteins–Empirical findings from Belgium. Future Foods, 4, p. 100088. https://doi.org/10.1016/j.fufo.2021.100088

[58] Affrifah, NS, Uebersax, MA & Amin, S 2023,' Nutritional significance, value-added applications, and consumer perceptions of food legumes: A review', LegumeScience, vol. 5, e192. https://doi.org/10.1002/leg3.192

[59] Duarte CM, Mota J, Assunção R, Martins C, Ribeiro AC, Lima A, Raymundo A, Nunes MC, Ferreira RB & Sousa I 2022, New Alternatives to Milk From Pulses: Chickpea and Lupin Beverages With Improved Digestibility and Potential Bioactivities for Human Health. Front. Nutr. Vol 9: 852907. https://doi.org/10.3389/fnut.2022.852907

[60] Drulyte, D. and Orlien, V., 2019. The effect of processing on digestion of legume proteins. Foods, 8(6), p. 224.

[61] Maroma, D. P., 2015. Meat analogue derived from common legumes. Open Access Library Journal, 2(1). https://doi.org/10.4236/oalib.1101249

[62] Maphosa, Y. and Jideani, V. A., 2017. The role of legumes in human nutrition. Functional Food-Improve Health Through Adequate Food, 1, pp. 103-121. https://doi.org/10.5772/intechopen.69127

[63] Saadat, S., Akhtar, S., Ismail, T., Sharif, M. K., Shabbir, U., Ahmad, N. and Ali, A., 2020. Multilegume bar prepared from extruded legumes flour to address protein energy malnutrition. Italian Journal of Food Science, 32(1), pp. 167-180.

[64] Bernat, N, Cháfer, M, Chiralt, A & González-Martínez, C 2014, 'Vegetable milks and their fermented derivative products', International Journal of Food Studies, vol. 3, no. 1.

[65] Vallath, A., Shanmugam, A. and Rawson, A., 2022. Prospects of future pulse milk variants from other healthier pulses as an alternative to soy milk. Trends in Food Science & Technology, 124, pp. 51-62. https://doi.org/10.1016/j.tifs.2022.03.028

[66] Kundu, P., Dhankhar, J. and Sharma, A., 2018. Development of non-dairy milk alternative using soymilk and almond milk. Current Research in Nutrition and Food Science, 6(1), pp. 203-210.

[67] Sarangapany, A. K., Murugesan, A., Annamalai, A. S., Balasubramanian, A. and Shanmugam, A., 2022. An overview on ultrasonically treated plant-based milk and its properties–A review. Applied Food Research, 2(2), p. 100130.

[68] Perera, O. D., Eashwarage, I. S. and Herath, H. M., 2017. Development of dietary fiber-rich multi-legume flake mix. Journal of Pharmacognosy and Natural Products, 3(1), pp. 2472-81.

[69] Fehér, A., Gazdecki, M., Véha, M., Szakály, M. and Szakály, Z., 2020. A comprehensive review of the benefits of and the barriers to the switch to a plant-based diet. Sustainability, 12(10). https://doi.org/10.3390/su12104136

[70] Matemu, A., Nakamura, S. and Katayama, S., 2021. Health benefits of antioxidative peptides derived from legume proteins with a high amino acid score. Antioxidants, 10(2), p. 316. https://doi.org/10.3390/antiox10020316

[71] Criste, A. D., Urcan, A. C., Coroian, C. O., Copolovici, L., Copolovici, D. M., Burtescu, R. F. and Oláh, N. K., 2023. Plant-based beverages from germinated and ungerminated seeds, as a source of probiotics, and bioactive compounds with health benefits—Part 1: Legumes. Agriculture, 13(6), p. 1185.

[72] Barman, A, Marak, CM, Barman, RM & Sangma, CS 2018, 'Nutraceutical properties of legume seeds and their impact on human health', Legume Seed Nutraceutical Research. https://doi.org/10.5772/intechopen.78799

[73] Ntukidem, V. E., Ukwo, P. S., Udoh, I. E. and Umoinyang, E. U., 2019. Influence of different pretreatments on the nutritional and organoleptic properties of vegetable milk produced locally from tiger-nut (Cyperus esculentus) tubers. IOSR-Journal of Environmental Science, Toxicology and Food Technology, 13(6), pp. 55-61.

[74] Ohanenye, I. C., Tsopmo, A., Ejike, C. E. and Udenigwe, C. C., 2020. Germination as a bioprocess for enhancing the quality and nutritional prospects of legume proteins. Trends in Food Science & Technology, 101, pp. 213-222.

[75] Jarecki, W. and Migut, D., 2022. Comparison of yield and important seed quality traits of selected legume species. Agronomy, 12, p. 2667. https://doi.org/10.3390/agronomy12112667

[76] Drewnowski, A., Henry, C. J. and Dwyer, J. T., 2021. Proposed nutrient standards for plant-based beverages intended as milk alternatives. Frontiers in Nutrition, 8, p. 796. https://doi.org/10.3389/fnut.2021.761442

[77] Su, W., Zhang, YY. and Li, S., 2024. Consumers' preferences and attitudes towards plant-based milk. Foods, 13(1), p. 2.

[78] Tangyu, M., Muller, J., Bolten, C. J. and Wittmann, C., 2019. Fermentation of plant-based milk alternatives for improved flavour and nutritional value. Applied Microbiology and Biotechnology, 103(23–24), pp. 9263–9275. https://doi.org/10.1007/s00253-019-10175-9

[79] Andaç, AE, Tuncel, NB & Tuncel, NY 2024, 'Characterisation of pea milk analogues using different production techniques', Food Technology and Biotechnology, vol. 62, no. 2, pp. 177–187.

[80] Tangyu, M., Fritz, M., Tan, J. P., Ye, L., Bolten, C. J., Bogicevic, B. and Wittmann, C., 2023. Flavour by design: Food-grade lactic acid bacteria improve the volatile aroma spectrum of oat milk, sunflower seed milk, pea milk, and faba milk towards improved flavour and sensory perception. Microbial Cell Factories, 22(1).

[81] Lal, N., Barcchiya, J., Raypuriya, N. and Shiurkar, G., 2017. Anti-nutrition in legumes: Effect in human health and its elimination. Innovative Farming, 2(1), pp. 32-36.

[82] Nawaz, M. A., Tan, M., Øiseth, S. and Buckow, R., 2020. An emerging segment of functional legume-based beverages: A review. Food Reviews International, 38(5), pp. 1064-1102.

[83] Lo Turco, V., Sgrò, B., Albergamo, A., Nava, V., Rando, R., Potortì, A. G. and Di Bella, G., 2023. Assessment of the accuracy of nutrition label and chemical composition of plant-based milks available on the Italian market. Foods, 12(17), p. 3207.

[84] Lopes, M., Pierrepont, C., Duarte, C. M., Filipe, A., Medronho, B. and Sousa, I., 2020. Legume beverages from chickpea and lupin, as new milk alternatives. Foods, 9(10), p. 1458. https://doi.org/10.3390/foods9101458

[85] Maria, M. F. and Victoria, T., 2018. Influence of processing treatments on quality of vegetable milk from almond (Terminalia catappa) kernels. Acta Scientiarum Nutrition & Health, 2(6), pp. 37-42.

[86] Demarinis, C., Verni, M., Pinto, L., Rizzello, C. G. and Baruzzi, F., 2022. Use of selected lactic acid bacteria for the fermentation of legume-based water extracts. Foods, 11(21), p. 3346.

[87] Kumari, M., Kokkiligadda, A., Dasriya, V. and Naithani, H., 2022. Functional relevance and health benefits of soymilk fermented by lactic acid bacteria. Journal of Applied Microbiology, 133(1), pp. 104-119. https://doi.org/10.1111/jam.15342

[88] Collard, K. M. and McCormick, D. P., 2020. A nutritional comparison of cow's milk and alternative milk products. Academic Pediatrics, 21(6), pp. 1067–1069.

[89] Afroz, MF, Anjum, W, Islam, N, Kobir, A, Hossain, K & Sayed, A 2016, 'Preparation of soymilk using different methods', Journal of Food and Nutrition Sciences, vol. 4, no. 1, pp. 11–17. https://doi.org/10.11648/j.jfns.20160401.13

[90] Belobrajdic, DP, James-Martin, G, Jones, D & Tran, CD 2023, 'Soy and gastrointestinal health: A review', Nutrients, vol. 15, no. 8, p. 1959.

[91] Abagoshu, NA, Ibrahim, AM, Teka, TA & Mekonnen, TB 2017, 'Effect of soybean varieties and processing methods on nutritional and sensory properties of soymilk', Journal of Food Processing and Preservation, vol. 41, no. 4, e13014.

[92] Modanwal, D., 2024. A study on extracted soymilk and their proximate analysis. Sustainability, Agriculture, Food and Environmental Research, 12(2).

[93] Agrawal, S, Dubey, S, Borde, B, Gawande, R, Sonone, D, Bhalerao, A & Dubey, A 2023, 'Soy protein: health benefits and body building', International Journal of Creative Research Thoughts (IJCRT), vol. 11, no. 10, p. b547. https://doi.org/10.56428/IJCRT2310176

[94] Sęczyk, Ł., Świeca, M. and Gawlik-Dziki, U., 2017. Soymilk enriched with green coffee phenolics–Antioxidant and nutritional properties in the light of phenolics-food matrix interactions. Food Chemistry, 223, pp. 1-7.

[95] Winarsi, H., Yuniaty, A. and Ramadhan, G. R., 2020. Anti-inflammatory effects of functional milk drink enriched with soya bean sprout protein in breastfeeding mothers. Malaysian Journal of Nutrition, 26(2).

[96] Akinmoladun, OF, Bamidele, OP, Jideani, VA & Nesamvuni, CN 2023, 'Severe acute malnutrition: The potential of non-peanut, non-milk ready-to-use therapeutic foods', Current Nutrition Reports, vol. 12, no. 4, pp. 603–616.

[97] Sharma, A., 2020. A review on traditional technology and safety challenges with regard to antinutrients in legume foods. Journal of Food Science and Technology, 58(8), pp. 2863-2883.

[98] Das, G., Sharma, A. and Sarkar, P. K., 2022. Conventional and emerging processing techniques for the post-harvest reduction of antinutrients in edible legumes. Applied Food Research, 2(1), p. 100112. https://doi.org/10.1016/j.afres.2022.100112

[99] Kumar, S. and Gautam, S., 2019. A combination process to ensure microbiological safety, extend storage life and reduce anti-nutritional factors in legume sprouts. Food Bioscience, 27, pp. 18-29. https://doi.org/10.1016/j.fbio.2018.11.005

[100] Nowshin, H., Devnath, K., Begum, A. A. and Mazumder, M. A., 2018. Effects of soaking and grinding conditions on anti-nutrient and nutrient contents of soy milk. Journal of Bangladesh Agricultural University, 16(1), pp. 158-163.

[101] Wang, S., Chelikani, V. and Serventi, L., 2018. Evaluation of chickpea as alternative to soy in plant-based beverages, fresh and fermented. LWT - Food Science and Technology, 97, pp. 570–572. https://doi.org/10.1016/j.lwt.2018.07.067

[102] Sofi, S. A., Muzaffar, K., Ashraf, S., Gupta, I. and Mir, S. A., 2020. Chickpea. In: Pulses: Processing and Product Development. Springer, pp. 55-76. https://doi.org/10.1007/978-3-030-41376-7_4

[103] Merga, B. and Haji, J., 2019. Economic importance of chickpea: Production, value, and world trade. Cogent Food & Agriculture, 5(1), p. 1615718. https://doi.org/10.1080/23311932.2019.1615718

[104] Kaur, R. and Prasad, K., 2021. Technological, processing and nutritional aspects of chickpea (Cicer arietinum)-A review. Trends in Food Science & Technology, 109, pp. 448-463. https://doi.org/10.1016/j.tifs.2021.01.044

[105] Aisa, HA, Gao, Y, Yili, A, Ma, Q & Cheng, Z 2019, 'Beneficial role of chickpea (Cicer arietinum L.) functional factors in the intervention of metabolic syndrome and diabetes mellitus', Bioactive Food as Dietary Interventions for Diabetes, pp. 615–627. https://doi.org/10.1016/B978-0-12-813822-9.00039-4

[106] Singh, V., Chauhan, Y., Dalal, R. and Schmidt, S., 2021. Chickpea. In: The Beans and the Peas. Woodhead Publishing, pp. 173-215. https://doi.org/10.1016/B978-0-12-821450-3.00003-2

[107] Pina-Pérez, M. C. and Pérez, M. F., 2018. Antimicrobial potential of legume extracts against foodborne pathogens: A review. Trends in Food Science & Technology, 72, pp. 114-124. https://doi.org/10.1016/j.tifs.2017.12.007

[108] Fabiszewska, A., Wierzchowska, K., Dębkowska, I., Śliczniak, W., Ziółkowska, M., Jasińska, K., Kobus, J., Nowak, D. and Zieniuk, B., 2024. Plant-based alternatives to mold-ripened cheeses as an innovation among dairy analogues. Foods, 13(14), p. 2305.

[109] Naeem, H., Akhtar, A., Akram, N., Suleria, H. A. R. and Khalid, N., 2024. Formulation and characterization of lentil milk–based soft cheese analogs: Insights on physicochemical and textural properties. Legume Science, 6(3).

[110] Ratnawati, L., Desnilasari, D., Surahman, D. N. and Kumalasari, R., 2019. Evaluation of physicochemical, functional and pasting properties of soybean, mung bean and red kidney bean flour as ingredient in biscuit. IOP Conference Series: Earth and Environmental Science, 251, p. 012026. https://doi.org/10.1088/1755-1315/251/1/012026

[111] Punia, S., Dhull, S. B., Sandhu, K. S., Kaur, M. and Purewal, S. S., 2020. Kidney bean (Phaseolus vulgaris) starch: A review. Legume Science, 2, p. e52. https://doi.org/10.1002/leg3.52

[112] Tang, J., Cui, L., Zhang, S., Wang, L., Hou, D. and Zhou, S., 2023. A novel plant-based milk alternative made from red kidney bean (Phaseolus vulgaris L.): Effects of cultivars on its stability and sensory properties. Food Bioscience, 56, p. 103362.

[113] Verma, P., 2016. Preparation and sensory evaluation of recipe prepared by incorporating legume extracts-bovine milk blends. Indian Journal of Health & Wellbeing, 7(2), pp. 259-262.

[114] Anino, C, Onyango, AN, Imathiu, S, Maina, J & Onyangore, F 2019, 'Chemical composition of the seed and "milk" of three common bean (Phaseolus vulgaris L.) varieties', Journal of Food Measurement and Characterization, vol. 13, pp. 1242–1249.

[115] Aydar, EF, Mertdinç, Z, Demircan, E, Çetinkaya, SK & Özçelik, B 2023, 'Kidney bean (Phaseolus vulgaris L.) milk substitute as a novel plant-based drink: Fatty acid profile, antioxidant activity, in-vitro phenolic bio-accessibility and sensory characteristics', Innovative Food Science & Emerging Technologies, vol. 83, p. 103254. https://doi.org/10.1016/j.ifset.2022.103254

[116] Kan, L., Nie, S., Hu, J., Wang, S., Cui, S. W., Li, Y., Xu, S., Wu, Y., Wang, J., Bai, Z. and Xie, M., 2016. Nutrients, phytochemicals and antioxidant activities of 26 kidney bean cultivars. Food and Chemical Toxicology, 108, pp. 467-477. https://doi.org/10.1016/j.fct.2016.09.007

[117] Wani, I. A., Sogi, D. S., Wani, A. A. and Gill, B. S., 2017. Physical and cooking characteristics of some Indian kidney bean (Phaseolus vulgaris L.) cultivars. Journal of the Saudi Society of Agricultural Sciences, 16(1), pp. 7-15. https://doi.org/10.1016/j.jssas.2014.12.002

[118] Lonardi, S., Muñoz-Amatriaín, M., Liang, Q., Shu, S., Wanamaker, S. I., Lo, S., Tanskanen, J., Schulman, A. H., Zhu, T., Luo, M. C. and Alhakami, H., 2019. The genome of cowpea (Vigna unguiculata [L.] Walp.). The Plant Journal, 98, pp. 767-782. https://doi.org/10.1111/tpj.14382

[119] Carvalho, M, Lino-Neto, T, Rosa, E & Carnide, V 2017, 'Cowpea: A legume crop for a challenging environment', Journal of the Science of Food and Agriculture, vol. 97, pp. 4273–4284. https://doi.org/10.1002/jsfa.8250

[120] da Silva AC, da Costa Santos D, Junior DL, da Silva PB, dos Santos RC, Siviero A. Cowpea: A strategic legume species for food security and health. Legume Seed Nutraceutical Research. 2018. https://doi.org/10.5772/intechopen.79006

[121] Jayathilake, C., Visvanathan, R., Deen, A., Bangamuwage, R., Jayawardana, B. C., Nammi, S. and Liyanage, R., 2018. Cowpea: An overview on its nutritional facts and health benefits. Journal of the Science of Food and Agriculture, 98, pp. 4793-4806. https://doi.org/10.1002/jsfa.9074

[122] Davy, P. and Vuong, Q. V., 2022. Soy milk by-product: Its composition and utilisation. Food Reviews International, 38, pp. 147–169. https://doi.org/10.1080/87559129.2020.1855191

Research Field

Aditi Garg: Nutrition, Food Product Development, Legume extract milk, Community Nutrition, Abdominal obesity

Sheel Sharma: Food Science and Nutrition, Clinical Biochemistry, Food Analysis, Nutritional status, Abdominal obesity, Garden cress, Free radical activity

Preeti Verma: Agriculture Science, Community Nutrition, Nutrition, Food Product Development, Legume extract milk