CHAPTER 1
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Nutrition plays an important role in prevention of health conditions like increased illness, reduced quality of life and premature death as well as chronic diseases. Diet low in fibre and high in calories, fats, saturated fat, cholesterol and salts are associated with increased risk of coronary heart diseases, cancer, stroke, diabetes, obesity and pregnancy problems. We majorly rely on three major crops i.e. wheat, rice and maize for 60% of the world’s calories. To secure our future, our crops need to evolve. Meeting the needs of the increasing population and ensuring everyone has access to affordable and nutritious food are major challenges to global agriculture [1].

The use of neglected plant species by people belonging to the marginalized areas of society, brings social benefits like providing food, economic benefits (such as creating employment along the value chain) and environmental benefits (such as conserving biodiversity) [2][3]. Root and tuber crops have tremendous importance in agricultural development as they hold important place in the dietary habits of small marginal farmers and tribal population.

These crops like cassava, sweet potato, yams and aroids enjoy considerable significance as a staple food, vegetable and raw material for small-scale industries at a global level, particularly in the less developed tropical countries [4].

Aroid is common name of Araceae family member’s plants, also known as the Philodendron or Arum family. Common edible aroids that are grown for food crop as well as for their beauty in India are Colocasia, Xanthosoma, Alocasia, Amorphophallus, etc. These aroids contribute for an important carbohydrate content diet of several developing countries regions. Edible starchy corms are produced after storage.

A. paeonifolius is highly potential tropical tuber crop of tropical and sub-tropical countries because of its yield potential. This crop can be grown under a wide range of conditions from small homesteads to large scale cultivation in the open fields and possess greater climate resilience. Elephant foot yam is widely grown and consumed in south eastern countries like India, Philippines, Malaysia and Indonesia. In India, it has gained the status of a cash crop
due to its high production potential, market acceptability and lucrative economic returns with a production potential (50-80 t ha\(^{-1}\)) [5]. It has a good source of protein, starch as well as minerals and is very popular as a vegetable in various Indian cuisines. In India, it is cultivated in Andhra Pradesh, West Bengal, Gujarat, Kerala, Tamil Nadu, Maharashtra, Uttar Pradesh and Jharkhand. The net economic return is over 1 lakh rupees per ha. It has a great export potential since its commercial cultivation is not in other countries [6].

The tuberous roots of the plant not only have blood purifier properties but also used traditionally for piles treatment, abdominal disorders, tumours, enlargement of spleen, asthma and rheumatism. Tubers also serve as tonic, stomachic and appetizer [7]. *A. paeoniifolius* have several medicinal properties like gastro protective ability, antioxidative, antidiarrhoeal and anti-inflammatory activity [8].

*Amorphophallus paeoniifolius* is an underutilized crop with remarkable nutritional quality and has potential to be a valuable food source for human consumption. Despite the economic importance of *A. paeoniifolius* as food material, there is very limited scientific information on their post-harvest characteristics, which perhaps contributes for its limited improved quality and marketing potential. Many of *A. paeoniifolius* varieties are having typical acridity which makes the crop unpopular for consumption. However the Gajendra variety of elephant foot yam developed at APAU, Hyderabad (India) is high yielding, free from acridity and is popularly grown all over India.

To improve the use of *Amorphophallus paeoniifolius* by the food industry, much research needs to be done in order to fulfil the current limited knowledge of the functionalities, availability of acceptable food products and its nutritional components, product processing technologies and utilization of waste. There is dearth in knowledge regarding the factors that impact product development with improved characteristics and longer shelf life from *A. paeoniifolius* corm and last but not the least food waste utilization also need to be explored.

The objective of this research was to evaluate and assess the complete utilization of *A. paeoniifolius* and study its potential in food industry. The utilization of *A. paeoniifolius* not only enhance the components of our vegetable basket but also helpful in increasing the beneficial effect of this corm.
Towards better understanding of *A. paeoniifolius* utilization, this study employs following objectives:

**“Processing of raw ingredients”** from *A. paeoniifolius* corm.

Here we examined the economical techniques that can be utilized for product development like blanching, dehydration for flour and starch, proximate, nutritional analysis of flour, extraction of starch, resistant starch and functional characterization of starch.

**“Development of Edible Products”** by utilizing *A. paeoniifolius* flour and corm (Bread and Osmo dehydrated Slices).

1. **Bread formulation:** Incorporation of *A. paeoniifolius* flour into bread formulation is an attempt to improve the product nutritional quality. We have checked for four different formulations of bread and reported that wheat flour could be replaced, up to 20% (w/w), with *A. paeoniifolius* flour, to obtain consumer acceptable bread with improved nutritional value, without compromising product quality.

2. **Quality characteristics of Bread:**
   - **Sensory evaluation:** Various sensory parameters were checked on 7 point hedonic scale to have a clear picture of consumer preference, perception and clear understanding of product characteristics. This analysis will increase developer confidence in product quality and help to find its marketability.
   - **Nutritional analysis and shelf life prediction of Bread:** Nutritional analysis was carried out to check the enhanced nutritional value of bread with normal available breads. Shelf life prediction is important to determine the duration of product quality, during storage.

3. **Osmo- dehydrated Slices** Osmotic dehydration is a procedure that involves immersing fruits or vegetables in a hypertonic aqueous salt or sugar solution. Here we have used different concentration of sugar solutions.

**“Screening, purification and application of enzymes from the corm”** was done and their potential applicability was studied.
1. **Screening, Characterization of Enzymes**: Here we have targeted polyphenol oxidase for role in browning, whereas cellulase, amylase and protease for softening of the vegetables. Cellulase helps to break down the cell wall in food industry. PPO could affect colour, odour and taste. The major useful factors in controlling enzyme activity i.e. temperature, pH, chemicals which can inhibit enzyme action, substrates alteration were checked.

2. **Application of Enzymes**: Juice clarification, Dough rising

“**Enzyme Kinetics and thermal inactivation of PPO**”

1. **Enzyme Kinetics**: The Km and Vmax values of PPO were measured by evaluation of the Lineweaver–Burk (1/Vo versus 1/[S] values) plots.

2. **Inactivation of PPO**: Here we report the thermal inactivation and thermodynamic properties of enzyme that can be utilized to inactivate the PPO enzyme so that the application of enzyme polyphenol oxidase is minimized in product development.

“**Utilization of Waste Peel**”

In this chapter we have screened the peel for presence of value added products like phytochemicals and enzymes. This chapter summarizes *Amorphophallus paeoniifolius* peels utilization, potential to meet the industrial needs and verification of bioactive ingredients that include important constituents for pharmacological activity.

1. **Antioxidant and phytochemical analysis**: Here we report the phyto-chemicals present and quantification of total phenol and proanthocyanidin within different extracts (aqueous, methanol, petroleum ether and chloroform) of the peel. The therapeutic potency of the peel was established by studying the anti-oxidative potential of these extracts by DPPH scavenging activity and phosphomolybdenum method.

2. **Screening and characterization of Enzymes**: Production of enzymes by the agro waste can propose alternative paths for the reuse of agro-industrial waste, as well as adding economic value to these co-products. Here we have checked for Cellulase and Polyphenol oxidase enzyme in the peel.