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A Review on Nutritional Value of Enset Ventricosum: Evidence from Ethiopia Context

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Abstract: *In Ethiopia, Enset (Ensete Ventricosum) is an indigenous perennial crop cultivated which is dominantly within the south and southwestern highlands. There are numerous enset varieties or clones mostly produced for the starch from the pseudo-stem while some are exclusively cultivated for corm. Kocho, corm (amicho), and Bulla are the most food products of enset. The corm (Neqaqa) found to be more nutritious than bulla except in starch and zinc contents. Enset is rich in starch but low in protein composition. Therefore, dietary protein source is mandatory. It plays great role within the food security of the country and a staple food significantly in Ethiopian. Furthermore, it has several environmental, nutritional, and socio-cultural importance. However, its cultivation is under disease challenges. Continual attempt is required to enhance the assembly of enset and its food products and fiber processing. Enset could be a drought tolerant crop, traditionally grown in Ethiopia. Currently, Enset has various benefits such as food, fodder, fibres and traditional medicine. Being perennial, enset recovers local climate and soil conditions. It could contribute to improved food security in several drought-prone parts of the planet. Water content was high, 85 to 90%, which is useful when used as fodder during dry periods. Enset corm comparable or higher concentration than potato of 12 of those contained 17 of 20 amino acids. The pseudo-stem, the most food source, was rich in soluble carbohydrates (80%) and starch (65%), but had low protein content (4%). Among the best available in Ethiopia, 20% crude fibre. Leaves had 13% protein and 10% sugar a decent fodder and suitable for ensilage. Therefore, Enset based diet must be supplemented with protein and complementary amino acids; for instance from beans, which are suitable to intercrop with enset.*

Keywords: Nutritional value, Bulla, Corm, Enset, Socio-culture, Variety.

1. Introduction

Enset (Enset ventricosum) may be a genus of Musaceae and termed as false banana. It is a big leafy monocarpic evergreen perennial harvest and main food source mostly for the southwestern a part of Ethiopian highlands. Bio-geographers and agronomists have considered the middle of origin for enset agriculture to be the Ethiopian highlands [1, 2]. In Ethiopia, other scholars have also presumed enset domestication to 10,000 years ago [3]. The representative Enset growing areas of southwest highlands in Ethiopia this does not mean that Enset is cultivated and used only in these regions as food. Its customary food within the southwest, central, towns, and cities with the Ethiopian delicious food, kitfo. Counting on the climate and agro-ecology, the most food crops and diet vary from region to region within the country. Thus, cautious interpretation is required on general statements of Ethiopian diet. In Ethiopia, Enset ventricosum is arguably the foremost important crop contributing to food security and rural livelihoods for about 1/4 (20 million people) of the Country's population [4].

Enset are a classic multipurpose crop that each botanical part is employed for varied material cultures. Enset could be a large banana like plant [3]. The leaves and pseudo-stems are utilized for wrapping, sheeting to sit down, thatching, making containers, shading from sunshine and protecting from rain [6]. The sheaths, leaf, and fiber, of the plant are used for house construction, food wrapping, cattle feed, and ropes [7]. It is also used for various socio-economic and cultural values within the Enset growing areas. Some varieties are needed sure as shooting ritual activities in big ceremonies and funerals the edible parts of Enset differ from place to place.

In general, the pulp of the pseudo-stem, the young shoots, and the corm eaten. The processed pseudo-stem usually undergoes fermentation, which becomes flour and ultimately the essential ingredient of bread and porridge upon drying. In some parts of the country the pseudo-stem pulp, together with the young shoots are boiled and eaten as a vegetable that tastes like Irish potatoes when fresh [8]. Seldom, the mealy substance of the seeds and therefore the pith of the inflorescence stalk are boiled and eaten [9, 10] though the three commonest enset derived foods are kocho, bulla, and amicho (corm). The plant is cut before flowering the pseudo-stem and leaf midribs are scraped, fermented for 10-20 days and becomes ready for various foods preparation. The juice of squeezed and dehydrated parenchymatic scrapings of the pseudo-stem gives a high-grade product. This product is named bulla, which is tightly packed in enset leaves and fermented during a silo [10]. The low-protein enset products are staple or co-staple foods without the specified protein supplement for people [7].

The processed of enset (kocho, bulla, and corm) are rich in carbohydrate and good sources of minerals. However, the starch yield and nutrient compositions vary among enset clones or varieties. Per AARC, over 265 enset clones has identified and characterized. Enset varieties are categorized to two main groups namely the kocho or psuedostem types and therefore the corm types. There occur variations within the qualities (color, texture, aroma, etc.) of the final enset products, which are affected mostly by enset variety and processing skills. Enset varieties that yield the whitest kocho and bulla color have considered to be the simplest quality while yield is incredibly important trait for a family food per farmers. The bulk of enset varieties have produced mainly for processing to starch through fermentation, kocho or bulla while another are produced entirely for his or her corm.

2. Reviewed Literature

2.1. Enset Cultivation in Ethiopia Context

In Ethiopia Enset plantation as a food crop has long history. Many scientists of varied disciplines have developed theories that assume enset domestication in Ethiopia to 10,000 years ago [3]. Early scholars considered the indigenous hunter/gatherers of southern Ethiopia could even be the first ones to cultivate enset [9]. Others also proposed that the Ethiopian highlands because the first center of origin for enset cultivation [1, 2, 12]. It is an indigenous crop to Ethiopia, where mostly cultivated as a staple food though wild enset varieties reported to be found in other African and Asian countries. Within the late 19th century, Stigand [15] designated enset as "groves of what looked as if it would be bananas" in his first impression within the Baka chief's area of Ari area. Cushitic-speaking people later introduced enset agriculture to the northern Ethiopian highlands so replaced by crops like wheat, barley, and teff following the migration of Semitic-speaking groups into northern Ethiopia [9]. It also reported the primary cultivation of enset within the northern an element of the Abyssinian highland within the course of his survey on the source of the Nile. Domestication Enset was delivered to southwestern Ethiopia sometime in prehistory of Sidamo tribes [16]. Northern part of Ethiopia Later the Agaw, central Cushitic-speaking peoples, began to grow enset and other crops like wheat, barley, cattle like goats and sheep into their economy [3].

Enset are the multipurpose use and propagation method of mostly shared by the Ethiopian agriculturalists that have classified as Omotic and Cushitic with one exception of Semitic people, Gurage [7]. Within the mid to highlands of Southern Peoples Nations Nationalities Regional State (SPNNRS), western Arsi-Bale, and western Oromia, enset is widely cultivated [8]. In step with Straube, the Amarro people harvest enset once they are needed since they are doing not ferment its starch as cited in Westphal [9]. It is used during the time of year when cereals are scanty otherwise, it is not so important like maize [9]. The aforementioned studies show the primary domestication of enset in Ethiopia and their gradual distribution pattern across the country and its importance as a staple and semi-staple food in various parts of the country.

As Figure 1 indicates that (a and b) Enset corm with newly emerging shoots; (c) young enset plantlets at second transplanting stage.(d) 2–4-year-old plants at second and third transplanting stages; (e) wider spacing at final transplanting stage, with fresh application of manure; (f) mature enset with dry leaf sheaths removed, ready for harvesting. Upper portion of the corm, with roots removed is also visible; (g) traditional hut in Hadiya Zone surrounded by enset; and (h) enset leaf sheaths appear adapted to store water. Here, water is observed over a month since the last substantial rain. [Shank and Ertiro, 1996. R. Shank, C. Ertiro]

Figure 1.

Source: Shank and Ertiro, 1996. R. Shank, C. Ertiro

2.2. Enset Foods and their Nutritive Value

Enset could be a strategic food reserve that ideally suited to bridge food shortage, a typical phenomenon in Ethiopia [45]. Outside Ethiopia, the inflorescence has eaten as an enjoyment in Malawi and therefore the bud is consumed as a boiled vegetable in many parts of geographic area [47]. The sort and number of enset clones cultivated in southwestern Ethiopia vary from place to position. Big numbers of clones are cultivated for numerous purposes, under different site and climate requirements. In each area, different clones are grown for various purposes [46]. This shows that the various livelihood requirements of a farmer partially, the whole covered by enset products. In areas where enset is an indigenous crop, it's the main source of human food supplemented with legumes and animal products [49]. Enset cultivation has existed increasing over the years in terms of area coverage and production. More than 2 million enset plant foods have produced each year. Enset crop loss is infrequent and production is high as compared to other crops [56].

Three main food items are prepared from enset such as Kocho (fermented product from the corm and pseudo-stem), Bulla (dehydrated product of the juice from the decortication of the pseudo-stem and grating of corm), and, Amicho is that the stripped corm of younger plants of enset, boiled and consumed [49].

In 2017/18 cropping season, 127, 235, and 588 enset plants were planted from which 29, 307, and 944.88, and 635.04; 34, 782, and 1, 017, and 821.63 quintals of Amicho, Kocho, and Bulla, respectively, were obtained [48]. Kocho is that the main enset food item. On average, one enset plant can produce 16.2 kg Kocho, which is reminiscent of 417 tons/ha. The common annual Kocho demand has covered about 16 plants, 289 kg [50]. Enset is processed for consumption annually from November to March, and processing is a wholly women's task. The methods employed in enset processing are more or less similar especially within the two steps (scraping of pseudostem and fermenting in a very pit) within the various enset-growing areas [49]. The starch deposits in these parts have extracted through fermentation [52]. When Bulla is required, the processed parts have squeezed and therefore the resulting liquid is collected. This is often, dehydrated until forming a powder called Bulla [51]. The fermentation period ranges

from weeks to some months and even to many years looking on environmental factors. The merchandise has taken into account ready for consumption after 90 days from the initial processing day, but it may kept for one or more years [47, 52]. Kocho may also be aloof from the pits PRN and baked used. Likewise, Bulla is white in color and comparatively small in production quantity as compared to Kocho, but it still fetches a far higher price. Sometimes, corm chunks of certain enset clones are not fermented but eaten as a boiled form called Amicho [47].

The traditional Kocho preparation process, lots of physicochemical properties and aerobic mesophilic microorganism counts have shown decreasing trend and completely inhibited members of Enterobacteriaceae because the process proceeds and pH lowers down. Moreover, carboxylic acid bacteria and yeast are identified because the major microorganisms in control of the fermentation of Kocho [53]. Different species of yeast like Cryptococcus albidus Var aerus, Guilliermondella selenospora, Rhodotorula acheniorum, and Trichosporon beigelii are identified, of which 99, 98, and 86% of them are Cryptococcus terreus, Candida zylandase, and Kluyveramyces delphensis, respectively [54]. The standard Kocho processing lowers treatable acidity, increases pH, and alters the microbial diversity and density, which subsequently improve the sensory detection of Kocho bread [55]. Kocho bread produced by the modified Gurage Kocho processing method incorporates a better sensory preference than the one produced by the standard method [55]. The findings of [56] have also shown that the length of fermentation time, amount of starter, and kind of starter strain affects the sensory attributes of Kocho. Furthermore, blending Kocho (up to 40%) with white wheat and soybean meal has improved the nutritional profile including protein content and also the congeniality of the foremost important bread sensory attributes like color, texture, and taste [57]. Enset foods are contains very rich in carbohydrates and fibres. The standard of enset products depends on the age, variety of clone, and method of processing [58].

The most effective quality Kocho is white in color and fewer fibrous produced when Bulla is not extracted [56]. Corms with few fibres are especially valued as they produce top quality Kocho. All-time low grade Kocho is darker and more fibrous and is a conclusion obtained after Bulla extraction [56]. Despite this perception, enset fibre incorporates a vital dietary value. Fibres' are the portions of plant foods that are proof against digestion by the human digestive enzyme. Individuals with high intakes of dietary fibre appear to be at significantly lower risk for developing coronary cardiovascular disease, stroke, hypertension, diabetes, obesity, and certain gastrointestinal diseases like oesophageal reflux disease, peptic ulcer, diverticulitis, constipation, and hemorrhoids [59]. Several findings have suggested the potential protective role of dietary fibre to rectal and carcinoma [60, 61]. This occurs through increase in fecal bulking and viscosity, which subsequently reduce the contact time of carcinogens within the intestinal lumen, production of anticarcinogen small chain fatty acids, and increase steroid deconjugation that further facilitates binding to carcinogens [60, 62].

Moreover, dietary fibres regulate many of the chance factors like hypercholesterolemia, hypertension, obesity, and kind II diabetes for coronary heart diseases. Dietary fibres prevent hypercholesterolemia by promoting the expression of major enzymes of β-oxidation and denovo lipogenesis and control the expression of some enzymes that minimizes cholesterol synthesis and augments excretion of cholesterol in bile [60, 63]. They also avert hypertension and obesity by slowing down carbohydrate absorption within the gut via increased viscosity [60]. Examples of enset products and commonly prepared dishes. In panel: A) three-enset primary products has shown. Above each primary product (in panel B), one example of a dish that can be prepared from the respective primary product is depicted.

Figure 2: Commonly prepared **Dishes**

Source: Itima and Doyisa uutta picture, Sadik Muzemil, AARC

2.3. Socio-Economic and Cultural Values of Enset

Enset could be a perennial evergreen crop with many aesthetic values and multipurpose within the south and southwestern Ethiopia. Its many material uses and socio-cultural values. An oversized number of enset plants around houses provide comfort, shading for people and a few crops like coffee, which require only moderate sunshine [7]. The employment of enset and its products for various purposes like food (amicho (corm), bulla, and kocho, medicine, rituals, and construction purposes could attribute to the existence of assorted enset varieties [21]. Enset garden is usually an indicator of the economic status of farmers; many types more mature and enormous number of enset plants are found within the gardens of wealthier households [25]. Gurage people depend much on enset socially and economically to get their essential needs [9]. Once it reaches certain stage of growth, cultivated enset will utilized for several purposes throughout a year [9]. Furthermost botanical parts of enset are good fodder for livestock. It is drought resistant because it contains plenty of water in pseudo-stem and used for cattle stall-feeding especially within the season when grass is scarce. It provides good fiber, a by-product obtained from decorticating the leaf sheaths and therefore the dried fibers are strong enough to create prime quality ropes. The pseudo-stem yields very strong fibers, even the unprocessed leaf sheaths is employed for tying livestock, bundling harvests from fields, and fencing [3].

The fiber has excellent structure and its strength is adore the fiber of abaca, excellent fiber crop. In rural areas, the fiber has employed to create sacks, bags, ropes, cordage, mats, construction materials, and sieves. About 600 heaps of enset fiber each year is shipped to factories for processing [23]. Fresh enset leaves used for wrapping foods, portion plates, and pit linings to store kocho for fermentation. Men sometimes make cap from enset and therefore the fresh leaves are used as clothes for women skirt, infrequently worn within the markets and ceremonies [7]. The dried petioles and midribs has used as firewood, to form mats, and tying materials for house construction. For cleaning rags, brushes, baby cushions, pot stands, as wrappers for butter, kocho, and other items to move to local market [3]. Specific varieties and enset parts are used medicinally for both human and livestock for problems like diarrhea, contraception (as an abortifacient), and supporting to discharge placenta [23]. Enset has cultural values through wedding and funeral ceremonies. During wedding, enset leaves will used on tables for serving food and as skirts for girls in some cases additionally to being the main food for the ceremony. Elucidated that at funeral ceremony, people beat the psuedostems of enset laid on the bottom in circle like drums and that they associate with enset leaves on their hands. The members of the lineage cut all the enset plants when the top of the household dies, to specific their sorrow and desperation [7]. The enset plant may also sold in some cases and the processed products like kocho and bulla have sold anytime within the rural markets and towns. Therefore, it has an on the spot cash income source for a family to shop for their daily needs.

2.4. Health and Traditional Medicine Benefits of Enset

Some enset varieties believed to own medicinal value and employed by the enset growing community. For instance, in Areka area, a spread called sweet which has strongly recommended for treating an individual with bone problem. This could be because it contains high calcium and phosphorous. Within the central highlands and cities where enset is not a staple, bulla has fed to a mother who gave birth for strengthening and fast recovery. They also make atmit (gruel) and given to someone caught cold. Different enset varieties have reported to own medicinal and non-secular (ritual) significances for prevention, healing, and other

therapeutic purposes [21]. Tayo could be a variety with a lightweight red pseudo-stem and midrib with deep green leaf. The boiled corm and starchy powder bulla of this variety is eaten with milk to cure ailments like joint displacement and swelling, broken bone fractures, and accustomed cure similar disorders in stock, specifically it's fed with salt to dairy cows. Some enset clones like Astara and Tayo have believed to own medicinal values and are accustomed treat human and livestock [44]. The corm of Enset is fed to stimulate placental discharge, minimize delivery-associated stomachache, eaten with cheese, butter, and milk. Officho, a dehydrated starch suspension and bulla used along with milk for bone related problems [21]. Furthermore, some clones have used for abortion or to cut back fertility.

Enset is broadly considered and very important medicinal plant in Ethiopia, with remarkable consistency across diverse ethnic groups in its reported uses, and the phenotypic traits that characterize medicinal values. Plants used medicinally mostly, but not consistently have red or reddish purple leaf blades with midribs and pseudo-stems that are red to a varying degree [8]. There are two principal medicinal properties commonly accredited to enset. First, boiled corm (amicho) of different varieties, often consumed with milk, allegedly cures fractured or broken bones, second, the amicho of various varieties have consumed with milk and butter to facilitate placental discharge in both humans and cattle. In some cases, it's going to also induce abortion Identified a unique phenylphenalenone in Enset, yet as compounds already known from other Musaceae [45]. Phenylphenalenones may have anti-cancer, anti-bacterial, and nematicidic properties and used the corm or other parts of specific Enset landraces to cure cirrhosis, diarrhoea or venereal diseases [42, 45]. The following are a number of the Enset clones that are claimed to own medicinal and ritual values by farmers [44]. Moreover, Choro is fed to a woman immediately after baby delivery to stimulate the discharge of placenta. In terms of formality significance, planting this clone in their backyard deters away the devil or evil spirits by Kaffa farmers. The bulla or corm of Tayo are consumed for bone fractures, backache, and swelling displacement of joints treatment. Shasi wagi (Wagi beli) is suggested for a girl to forestall uterus contraction and relive stomachache after baby delivery. The corm of Ariko is boiled and fed when an individual catcher’s flu. Additionally, children eat its uncooked stem to stay healthy and gain weight. However, the scientific clinical studies of those enset medical uses had not reported. In fact, its potential use as glucose source has recommended thanks to its rich carbohydrate content. Focusing totally on the corm (amicho) by the farmers signifies their appropriate cognitive content of its better nutrient composition.

3. Conclusions

Enset is a multipurpose evergreen tree crop staple food for significant in Ethiopian population. It is indigenous to Ethiopia and believed to be originated in the southwestern part of the country. It has several socio-economic and cultural values developed by the society for many years. Therefore, supplementary food sources of protein and minerals are highly recommended for people who entirely depend on especially bulla/kocho. Nutritional profile, enset is the best source of carbohydrates, ash and fiber contents but has less content of proteins and fats. Minerals such as calcium and potassium are abundant in the enset, which is very important for consumers. Although the protein content is limited, Enset foods possess good concentration of essential amino acids such as lysine, histidine and isoleusine. Enset products have moderate anti-oxidant properties compared to other staples. In addition, nutritious varieties need to be selected and promoted. In order to sustain and improve enset cultivation, serious and continuous work is required to control diseases, improving its productivity, and nutritional schemes. Furthermore, its products need to be processed in factories with better quality and high market values.

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