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Commentary

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Fidelis M.K. Kpodo is a lecturer at the Faculty of Applied Sciences and Technology, Ho Polytechnic, Ghana- where he teaches nutrition, food science and food technology related courses. Aside his core duties as a teacher, Fidelis has a strong passion for research and laboratory work. He has peer reviewed journal articles which are focused on the effect of ingredient variations on the physicochemical, functional, rheological and sensory characteristics of soy, peanut and cowpea products. He obtained an Mphil. in Food Science from the University of Ghana, a Post Graduate Diploma in Education from University of Cape Coast and a BSc. degree in Biochemistry from Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. He has research experience in the area of Food chemistry and rheology, Food product development, Food sensory and nutritional analysis. As a food scientist his major drive is to investigate the potential of underutilized plants to help combat food insecurity. His current research is focused on the isolation and characterization of food polysaccharides from indigenous underutilized plants like okra, for their beneficial applications in food and non-food systems.

Commentary: Okra Polysaccharides- Food, Non-Food and Medicinal Applications

Okra (*Abelmoschus* spp.) is a staple vegetable in Ghana and several African countries. The most important okra producing countries include India, Nigeria, Pakistan, Ghana and Egypt [1]. The crop has immense potential in enhancing the livelihoods of poor rural farmers should different genotypes be assessed in terms of seed, yield and post-harvest quality, coupled with a detailed understanding of the behavior of its biopolymers in food and non-food systems to enhance its unique technological applications**.** The vegetable is an important part of the diet of Ghana and other African countries. Worldwide production

of okra is estimated at 7 million MT whereas that of Ghana is over 60,000 MT and is worth $38 million [2]. Okra has high economic value, good nutritional and functional properties and can improve food security. Okra is found in Ghanaian markets due to its commercial value for women farmers/marketers who cultivate the vegetable on a small scale.

The polysaccharides from okra have food, non-food, medicinal and physiological benefits, critical for its extensive and diverse usage to encourage production and hence improve the livelihoods of local farmers. Despite the potential of this crop, it is underutilized in Ghana and most African countries, partly due to limited knowledge on the specific genotype for other food, non-food and medicinal uses. The market value of okra decreases when in season due to limited use in soup/stew preparation. Local farmers also lack adequate knowledge on practices to produce varieties and maximize production for specific technological applications.

The polysaccharide content of okra is responsible for the slimy texture of okra extracts and is of major technological interest for food, non-food and medicinal applications. Okra mucilage is composed of acidic polysaccharides mixed with proteins. The mucilage obtained from the pods produces stringiness when dispersed in water and hence it is used as a thickening agent to impart characteristic viscosity and smoothness, known as the okra effect [3]. Okra polysaccharides consist of galactose, rhamnose and galacturonic acid and are predominately pectins [4]. Different varieties of okra have different mucilage yield and composition. Aside varietal differences, variations in extraction procedure can also influence the actual constituents of the mucilage content of okra and their functional and rheological properties. A preliminary work on isolation of polysaccharides from eight (8) different local genotypes subjected to the same experimental procedure revealed that the local genotypes used in Ghana had different and considerable polysaccharide yields which can be exploited for their potential applications [5].

Okra polysaccharides have useful applications in food systems apart from use in stews and soups. The polysaccharides can potentially replace egg white and fat in chocolate bars or frozen desserts [6]. Okra polysaccharides have unique water holding capacity and solubility properties that can strengthen dough used for bakery-cakes and cookies. Okra extracts have been used to increase the firmness of bread loaf due to water migration from the crumb to crust. Okra polysaccharides have shown good emulsion stability properties under acidic environments and hence have potential applications in fruit drinks and acidified dairy products [4, 7, 8, 9]. The inclusion of okra powder in *ojojo*-a fried yam snack significantly increased the viscosity and dispersability of the reconstituted yam flours and also the sensory attributes of fried yam products subsequently developed [10].

Natural gums and mucilage have been widely used in drug formulations as thickeners, emulsifiers, stabilizers, gelling agents, granuleting agents, suspending agents, binders, film formers, disintergrants and as sustained release matrixes [11]. The preference of natural gum over synthetic gum in drug formulations is because products from the natural polymer are economical, readily available, non-toxic, capable of chemical modification,

biodegradable and biocompatible [11, 12]. Okra gum in drug formulations serves as a binder and shows a faster onset and higher ability of plastic deformation than drug containing gelatin [12]. Okra gum produces tablets with extended disintegration times [12, 13]. The polysaccharides have been successfully used to create modified release drug formulations due to their excellent swelling and dissolution properties. Hence it is used as hydrophilic matrix tablets which acts as an oral drug delivery vehicle for controlled drug release applications [7].

Okra polysaccharides can be used for non-food applications such as brightening agent in electro deposition of metals, as deflocculant in paper and fabric production, and as a protectant to reduce friction in pipe-flow. It has been used in the treatment of textile waste water because the polysaccharides acted as better flocculants due to their peculiar structure, high reactivity and excellent selectivity towards aromatic compounds. The polysaccharides can be combined with acrylamide to develop new biodegradable polymeric materials.

Some physiological benefits of okra as summarized by Kumar *et al*. [14] include the following: Okra contains special fibres which could be used to manage blood glucose levels; Mucilage in okra mop bad cholesterol and toxic substances in the body; Purgative properties of the polysaccharide are useful in bowel purification; The fibre contains valuable nutrients for intestinal microorganisms; Okra is an effective remedy for ulcers, it is used to counteract the acids; Okra is applied as treatment for pulmonary inflammations and bowel irritation.

Considering the immerse potentials of okra, there is the need for training and research into the agro-morphological, seed and post-harvest qualities of the crop for selection of potential genotypes for biochemical studies. In Ghana, crushed okra stem bark is used as a clarifying agent in the manufacture of pito an indigenous African beer obtained through yeast fermentation of wort extracted from sorghum [15]. My research focus is thus to isolate polysaccharide extracts from different okra genotypes and characterize their unique properties for useful applications in food systems. This effort is aimed at finding diverse use of the crop, increase production of okra, leading to job creation and income generation for local farmers and marketers. This research would ultimately improve the economic value of okra and greatly contribute to food security and improve the livelihood of okra farmers, mostly women.

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