Nigerian Food Journal
Official Journal of Nigerian Institute of Food Science and Technology www.nifst.org
NIFOJ Vol. 32 No. 2, pages 48 – 55, 2014

Quality Assessment of Nigerian Honey Sourced from Different Floral Locations

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ABSTRACT
Comparative studies on the quality of honey obtained from different floral locations in Nigeria were investigated. Parameters such as physical properties, chemical, mineral, microbial contents and antimicrobial activity as well as organoleptic quality were evaluated. The results of the physico-chemical properties show the following range of values for acidity (1.36 – 1.55%), soluble solids (80.96 – 82.00%), specific gravity (1.41 – 1.44) and sweetness index (52.52 – 62.73). While the proximate values were: moisture (15.69 – 18.41%), protein (0.90 – 1.15%), fat (0.12 – 0.21%), ash (0.26 – 0.38%) and carbohydrate (79.94 – 82.71%). Potassium (55.31 mg/100 g) and calcium (5.14 mg/100 g) were the dominant minerals in the honey samples. The highest microbial count was observed in sample NSK (1.4±0.14 x 10^2 cfu/100 g). There were no observable coliform growths in all the samples. All the honey samples exhibited antibacterial activities with clear zones that range from 2.05 – 6.10 mm. Honey samples KAD and ABJ had the best overall acceptance scores of 8.49 and 8.27 respectively.

Keywords: Honey, proximate, mineral, antibacterial, organoleptic.

Introduction
Honey is a delicious viscous sweetener made naturally by bees for their own nourishment from the nectar or secretion of flower plants. Honey has a long history of human consumption as a natural food source and is also used as ingredients in various food preparations, in both alcoholic and non-alcoholic beverages as sweeteners and in confectionaries as flavouring agents (Adebiyi *et al.*, 2004; Durrani *et al*., 2011; Eleazu *et al.*, 2013).

Although the food ranking system did not qualify honey as a dense source of traditional nutrients apart from the sugar content, it did emerge as a veritable source of vitamin B_2, vitamin B_6, iron and managanese (Alvarez-Suarez *et al.*, 2010; Vanhanen *et al.*, 2011).

Thus, honey has been used since ancient times not only as food but as a medicine and in cosmetics. Honey has been credited for many biological and therapeutic purposes such as: treatment of colds, skin wounds and various gastrointestinal diseases. This beneficial role is attributed to both the antimicrobial and anti-inflammatory properties of honey that arise from the low acid nature, high sugar, mainly of glucose and fructose components (Amril and Ladjama, 2013). Raw honey contains glucose oxidase which combines with water to produce hydrogen peroxide, a mild antiseptic (Amiot *et al.*,1989). In addition, other enzymes found in honey also help in the healing process (Khalil *et al*., 2010). Honey also contains phytochemicals such as flavonoids and other polyphenols that make it a

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potent functional ingredient and as an antibacterial agent (Khalil *et al*., 2010; Gulfraz *et al*., 2011; Ramanauskiene *et al.,* 2012).

The composition and quality of honey vary, depending on the climatic region, whether wet or dry, the environmental temperature, the type of botanical plant used to produce it, the honey bees species, the sugar composition, the treatment of honey during extraction, processing and subsequent storage conditions (Alvarez-Suarez *et al.*, 2010; Amril and Ladjama, 2013). Honey comes in a range of colours including white, amber, red, brown and almost black (Eleazu *et al*., 2012). Its flavour and texture also vary with the flower nectar from which it was made. While the most commonly available honeys are made from clover, alfalfa, heather and acacia flowers, honey can be made from a variety of different flowers including thyme and invender (Azenedo *et al.,* 2003; Alvarez-Suarez *et al*., 2010).

Commercial honeys are sold in individual containers or in bulk. They are available as raw or processed honey. The latter is usually pasteurized, clarified, or filtered and at times fortified. Raw honey is of the highest organic quality and is regarded as 100% pure (Amiot *et al.,* 1989; Ramanauskiene *et al*., 2012). The microorganisms of interest in honey are those that can withstand the concentrated sugar content, acidity and antimicrobial action of honey. They include certain yeasts and spore-forming bacteria (coliforms), indicative of the sanitary condition of the honey (Eleazu *et al.,* 2012).

In Nigeria the demand for honey is ever increasing because of the nutritional and medicinal benefits. This is supported by the huge botanical endowment and the natural biodiversity, which makes the production very lucrative. However, reports of the physico-chemical and sensory quality of available honey varies for different locations (Snowdon and Cliver, 1996; Gulfraz *et al.,* 2011). This is compounded by the preponderance of adulterated honeys, whose qualities are difficult to ascertain. It is thus pertinent that the dealers and consumers be well informed of the quality of the honey that they are purchasing.

The purpose of this study therefore is to evaluate and provide more data on the physico-chemical composition, microbial quality, anti-microbial activities and organoleptic attributes of honey samples from different geographic floral locations in Nigeria.

Materials and Methods

Collection of honey samples

Four honey samples were each sourced from different geographic regional locations in Nigeria. The samples were collected from different honey markets at different geographical regions of the country namely Kaduna (northern region), Abuja (central region), Nsukka (eastern region) and Ibadan (western region). They were labelled as KAD, ABJ, NSK, and IBD samples respectively. The control sample IMP was a product from United States of America. All the honey samples were stored at ambient temperature, in sample plastic-bottles with tight-fitting lids, during the period of analytical investigation.

Physico-chemical analysis

The pH, brix (soluble solids) and specific gravity of the juice samples were measured using standardized instrumental methods (AOAC, 1990). The acidity was determined by titration against 0.1M sodum hydroxide using phenolphalein as indicator (Jacobs, 1999). The sweetness and astringency indexes were calculated as the ratio of soluble solids to acidity and vice versa (Wardy *et al*., 2009). The proximate composition of the honey samples were determined as described by Onwuka (2005): the moisture contents by indirect distillation drying method; ash content by the muffle furnace ignition method; fat content through the solvent extraction method in a continuous reflux system using the soxtlet apparatus. The protein contents were determined by the formal titration method, while the carbohydrate and energy contents were determined by recommended mathematical procedures.