Physicochemical Quality of Street Vended Roasted Cashew nuts in Tanzania

Hamisi Abdallah Ramadhani, Neema Kassim, Beatrice Lyimo, Athanasia Matemu*

The School of Life Sciences and Bioengineering,
Nelson Mandela African Institution of Science and Technology,
P. o. Box 447, Arusha-Tanzania
*Author to whom correspondence should be sent: *athyone@yahoo.com*

ABSTRACT

Moisture content and pH values are very important factors for fungal growth of roasted cashew nuts. A survey to investigate storage practices of roasted cashew nuts was conducted along the Coastal regions. Physicochemical properties (moisture content and pH values) of roasted cashew nuts from processors and vendors were also evaluated. From the survey, it was found that, immediately after roasting, cashew nuts were stored in plastic buckets (87.5%) and other materials such as paper boxes (12.5%). For retailing purposes, plastic films (polyethylene bags) were the main packaging materials used (97.5%) and paper wrappings (2.5%) respectively. The moisture content were in a range of 3.72 ± 0.31 to 4.36 ± 0. 15 and 3.80 ± 0.19 to 4.59 ± 1.85% for roasted cashew nuts from processors and vendors respectively. The pH values of roasted cashew nuts from processors and vendors were 6.21 ± 0.10 to 6.52 ± 0.21 and 6.37 ± 0.15 to 6.58 ± 0.07 respectively. The pH values observed were in a range which is conducive for fungal growth and toxin production. Therefore, a need to ascertain physicochemical quality as pre-determined factors for fungal growth in roasted cashew nuts is relevant to ensure quality and public health safety.

Key words: Roasted cashew nuts, pH, moisture and storage practices

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INTRODUCTION

Tanzania is a leading producer of cashew nuts (*Anacardium occidentale L.)* in Africa followed by Mozambique and Ivory Coast, and world's fifth biggest producer after India, Vietnam and Brazil (Sostowski and Waxman, 2007). Coastal regions of Tanzania are famous for producing and processing cashew nuts. Mainly, cashew nuts are produced and processed in Mtwara, Lindi, Pwani, Tanga and Ruvuma regions (Kilama, 2013). Cashew nuts contributed over 80% of the Regional GDP (Fynn, 2004). In 2012, Tanzania produced, 158,000 metric tons of cashew nuts out of this 88% was exported as raw nuts, while 12% was processed internally (Trust, 2013). Most of cashew nut processing in Tanzania is done manually mainly by small scale processors. Cashew kernels is ranked as either the second or third most expensive nut traded in the United States, in which retail prices range from about US$ 9 to 23 per kg (Azam-Ali and Judge, 2001). In Tanzania, domestic consumption of cashew nuts in 2012 soared due to improved distribution systems through street vendors, shops, mini markets, and supermarkets (CBT, 2013). The retail prices of cashew kernels in local market ranged from Tsh. 10,000 to 17,000 per kg and in major cities roasted kernels are sold up to Tsh. 20,000 to 25,000 per kg. Globally, cashew kernels are held with great esteem in many customs and cultures because of their pleasant taste and flavor (Irtwange and Oshodi, 2009). It is estimated that 60% of cashew kernels are consumed in the form of snacks while the remaining 40% are included in confectionery (UNIDO, 2011). Kernel, which is the edible part of the nut, contains 47.8 g of crude fat, 29.9 g of carbohydrate, 16.8 g of protein and 574 kcal of energy per 100 g of intake (Brufau et al., 2006). Epidemiological studies showed that, frequent consumption of cashew kernels reduced incidence of coronary heart disease (CHD), cholesterol-level, hypertension and gallstones in both genders and diabetes in women (Mukuddem-Petersen et al., 2007). Post-harvest handling and storage of cashew nuts starts immediately after harvesting. Cashew nuts are dried for about 3 days to attain the required moisture content of 8-10%. Storage with moisture content above 10% will result into decay or rotting of the nuts. The dried nuts are sorted into grades and stored in a jute/sisal bags to prevent mould growth. Inappropriate storage practices, for example the use of plastic or fertilizer bags instead of jute bags and not using pallets to stack nuts often results in deterioration in cashew nut quality (UNIDO, 2011). Cashew kernels absorbs and retain moisture (hygroscopic) from the atmosphere until when they are at equilibrium with the atmosphere (Adebajo and Diyaolu, 2004). The inappropriate storage practices may create favorable conditions for mould growth and toxin production, hence predisposing the roasted cashew nuts into mycotoxins contamination. Since, physicochemical parameters are important determinants of storage quality of roasted cashew nuts, studies on the moisture and pH values are necessary for quality control and safety

assuarance. Therefore, studies on the physicochemical quality of street vended cashew nuts is necessary since no studies has been found in Tanzania. Thus, the aim of this study was to evaluate the physicochemical properties of roasted cashew nuts as pre-determined factors for fungal growth as it is affected by storage practices.

MATERIALS AND METHODS

Materials

A total of 120 packages of roasted cashew nuts (250g each) were collected from Newala, Nachingwea, Mkuranga and Pangani. Fifteen packages were collected from different processors and vendors. The cashew nuts were aseptically transferred into sterile polyethylene bags, and contents from the same district were thoroughly mixed together respectively. The study districts were selected based on cashew nuts. production and processing volume. All other chemicals and reagents used in this study were of analytical grade.

Questionnaire Survey

A survey was conducted in February and March, 2014 to investigate the storage practices for roasted cashew nuts. Eighty roasted cashew nut processors and vendors in the four selected were interviewed. In each district, 10 small scale processors and 10 vendors were selected. Information on storage practices of roasted cashew nuts were gathered and the packaging materials were carefully assessed.

Moisture and pH Determination

Moisture and pH of the roasted cashewnuts were determined according to the method described by (Adebajo and Diyaolu, 2004). About 75g of the sample was blended (Singsung-Singepore) and the moisture content of about 5g bits was determined at 103 ºC for 4.5 h. The moisture content was expressed as percentage moisture content on dry basis. The pH values of 1:2 (w/v) suspensions of the pulverized materials in distilled water were also obtained.

Data Analysis

The results represent the means ± standard deviations (SD's) of triplicate determinations. The data were analyzed using Microsoft Excel (2007) and presented as descriptive statistics

RESULTS AND DISCUSSION

Cashew nut Processing and Vending

Form the study, it was found that processing of cashewnuts were done by both men (40%) and women (60%). Youth (32.5%), at age between 30 - 39 years were more involved in cashew nut processing (**Table 1**). The education level of the most of the processors was primary (92.5%), secondary (5.0%) and only 2.5% with college education respectively. Preliminary studies have shown that, in the Coastal regions of Tanzania more females were engaged in cashew nuts processing sector than males, half of them were at the age of 30 - 40 years (UNIDO, 2011, Kilama, 2013),. Roasted cashew nut vending was done by both males (52.5%) and females (47.5%) respectively (**Table 1**). Similar to cashew nuts processors, majority of vendors were youth (55%) at age of 20 - 29 years. Seventy percent of the vendors had primary education and only 30% had secondary education. Youths involvement in street foods vending, including cashew kernels has also been reported by (Ndhlovu, 2011, FAO, 2012). This shows that, the sector is highly dominated by self employed youths who depends on cashew nut processing and vending for their livelihoods. The sector has a brighter future, except for the low educational background which may be a hindrance to technological advancement (Ayamdoo et al., 2013). Therefore, cashew nut processing and vending can contribute to improved socioecomical status of the self-employed youths along the coastal regions.

Table 1: Demographic and Social Characteristics of Cashew nuts Processors and Vendors

Categories		Procesors	Vendors
		No. Respondents (%)	No. Respondents (%)
Gender	Male	16 (40)	21(52.5)
	Female	24 (60)	19(47.5)
Age (years)	10 - 19	3 (7.5)	2(5)
	20 - 29	6 (15)	22(55)
	30 - 39	13 (32.5)	10(25)
	40 - 49	12 (30)	4(10)
	50 - 59	4 (10)	-
	60 - 69	2 (5)	2(5)
Eduaction level	Primary	37 (92.5)	28(70)
	Secondary	2 (5)	12(30)
	College	-	-

Storage Practices of Roasted Cashew nuts

Table 2 show results of storage and packaging practices of roasted cashew nuts from processors and vendors. From the survey, 87.5% of the processors were using plastic buckets as storage containers and other materials such as paper boxes (12.5%) (**Table 2**). Packaging of roasted cashew nuts for vending was mainly done in plastic films (polyethylene bags) of different sizes (97.5%) as well as paper wrappings (2.5%) (**Table 2**). According to (Azam-Ali and Judge, 2001) plastic films are commonly used in African countries as packaging materials. Inappropriate storage and packaging materials may impair keeping quality of the roasted cashew nuts therefore to accelerate its spoilage. Inappropriate storage conditions of the packaged roasted cashew nuts may result in moisture build up and condensation which may then become favorable environment for mould growth. The use of proper packaging materials and storage under proper conditions ensures good keeping quality hence extended shelf life. Packaging of cashew kernels shall be of sufficient strength to assure the integrity of the product during normal shipment and storage with an airtight (hermetic) seal (AFINuts, 1999). It was also observed that poor handling practices were common among processors and vendors. Packaging and re-packaging of roasted cashew nuts was done using bare hands by 100% (processors) and 52.5% (vendors) respectively. This practice may possibly contribute to contamination of roasted cashew nuts. Poor hygiene practices by processors and street-vendors expose roasted snacks (cashew nuts, doughnuts and peanuts) to contamination (Abdulla, 2013). Therefore, knowledge on proper handling, storage and packaging practices is needed to ensure safety and quality of roasted vended cashew nuts.

Table 2: Storage Containers and Packaging Materials for Roasted Cashew nuts

Storage containers for Processors	No. Respondents (%)	Packaging materials for Vendors	No. Respondents (%)
Plastic buckets	35(87.5)	Plastic films/bags (polyethylene bags)	39(97.5)
Paper boxes	5(12.5)	Paper wrappings	1(2.5)
Total	40(100)	Total	40(100)

Physicochemical Properties of Roasted Cashew nuts

The moisture content and pH values of roasted cashew nuts obtained from processors and vendors are shown in **Table 3 and 4** respectively. The moisture content of roasted cashew nuts were in a range of 3.72 ± 0.31 to 4.36 ± 0.15% for processors and 3.80 ± 0.19 to 4.59 ± 1.85% for vendors respectively. Similar findings of 2.9 - 5.9% moisture content of roasted cashew nuts was also reported by (Adebajo and Diyaolu, 2004, Aremu et al., 2006, Irtwange and Oshodi, 2009, Yadaw, 2010, Lima et al., 2012). Moisture level of 3 - 5% in cashew kernels were also reported (AFINuts, 1999). The recommended moisture content for safe storage of roasted cashew kernels is reported to be not more than 5% (Salunkhe and Kadam, 1995; ENP's, 2014). Roasted cashew nuts are colloids materials (hygroscopic), which tends to absorb moisture from the surrounding atmosphere until it reaches at equilibrium (Oladapo et al., 2014). Nevertheless, the observed moisture content was within recommended values consequently minimizing the chances of predisposing roasted cashew nuts into conducive environment for fungal growth. One characteristic of the coastal region's climate is the high atmospheric humidity, which often goes up to 100% maximum and 65 to 70% minimum with temperature of approximately 30 - 32 $^{\circ}$C during the day and about 26 - 29 $^{\circ}$C during the night (Malocho, 1997). According to (Irtwange and Oshodi, 2009), the best storage relative humidity of roasted cashew nuts was determined to be 47.2% under which conditions, storage period should not exceed 14 days for best quality.

Table 3: Moisture Content of Roasted Cashew nuts

Districts	Processors	Vendors
Nachingwea	4.02 ± 0.56	3.80 ± 0.19
Newala	3.72 ± 0.31	4.59 ± 1.31
Mkuranga	4.36 ± 0.15	3.91 ± 0.21
Pangani	4.35 ± 1.54	4.59 ± 1.85

The moisture content are represented as percentage in dry basis (%). Each value represents the mean ± SD, (n=3).

Table 4: pH values of Roasted Cashew nuts

Districts	Processors	Vendors
Nachingwea	6.28 ± 0.09	6.37 ± 0.15
Newala	6.21 ± 0.10	6.32 ± 0.11
Mkuranga	6.40 ± 0.17	6.58 ± 0.07
Pangani	6.52 ± 0.21	6.52 ± 0.17

The pH values are represented as mean ± SD, (n=3).

The pH values of roasted cashew nuts were in a range of 6.21 ± 0.10 to 6.52 ± 0.21 for processors and 6.37 ± 0.15 to 6.58 ± 0.07 for vendors respectively (**Table 2**). Cashew kernels from both processors and vendors showed pH values close to neutrality. Cashew nuts with pH values ranging from 5.10 - 6.70 were reported by (Adebajo and Diyaolu, 2004, Lima et al., 2012, Soares et al., 2012, Sengar et al., 2012, Idah et al., 2014), these findings support the pH values oberved in this study. The fact that, cashew nut trees grow well in the soil that has pH values ranged from 4.5 to 6.5 (Ngatunga et al., 2001, Kasuga, 2013) may contribute to the oberved pH values. Most moulds will grow at a pH range of 3 to 7 with exception of *Aspergillus niger* and *penicillium funiculosum* which grow well at pH 2 and below (Jay et al., 2005). Therefore, the observed pH values were in a range which may favor fungal growth hence mycotoxins contamination.

CONCLUSION

The observed moisture content of the roasted cashew nuts was within recommended values however, the pH values were above the recommended storage value. High pH values may favor fungal growth, hence mycotoxins contamination. Plastic buckets and plastic bags of different sizes were used as storage and packaging materials. Most of the processors and vendors were not aware of the good strorage, processing, packaging and pracitces, therefore training on good food handling practices is neccessary for improving storage quality and safety of the roasted cashew nuts.

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