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Production practices of table salt by small-scale miners in Tanzania: A case study of Nkonkilangi, Singida, Tanzania

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In Tanzania, a small-scale salt enterprise supplies salt which is mainly consumed within the country. However, the producers often lack appropriate production knowledge. The purpose of this study was to assess salt processing and handling practices at Nkonkilangi village in Singida region, Tanzania. A cross-sectional study design was used to collect data. Scheduled interviews with 63 out of 100 producers were conducted using semi-structured questions. The producers were exclusively women (100%) with primary school education (98%) and aged from 20 to 60 years (90.5%). Although 33.3% of the producers attended food processing and hygiene training, none used improved methods. The traditional method used involved mixing three soil types locally known as *Nkuluse, Mbuga and Sepa*, or *Nkoko* in the ratio of 1:1:1 (v/v/v). Brine is obtained by leaching the soil with water in perforated clay pots. Majority (63.5%) of the producers boil brine for 1 - 2 h for salt recovery, up to 5 batches per day. Three buckets of brine yield 1 bucket of salt. Two-thirds of the producers clean equipment and containers without detergents. More than 84% of the salt producers identified sand as major contaminant, whereas 47.6% of the processers use pieces of plastics and broken guards to stir salt during cooking. The salt is conditioned and packed for delivery. Despite the fact that salt fortification is mandatory in the country, none of the processers fortified the salt with iodine. Majority were neither aware of the nutritional benefits of fortification (90.5%) nor of the legal implications of selling non-iodized salt (79.4%). Therefore, proper control and monitoring of small-scale mining in Tanzania is essential for assuring quality and safety of salt.

Key words: Salt, salt quality, iodized, salt mining, contaminants, soil, plastic, Nkonkilangi.

INTRODUCTION

Salt is an important commodity for public health. Universally salt has been used as a vehicle to facilitate access of consumers to iodine (Etesin et al., 2017; Ba et al., 2020). Salt is used as flavour enhancer, food

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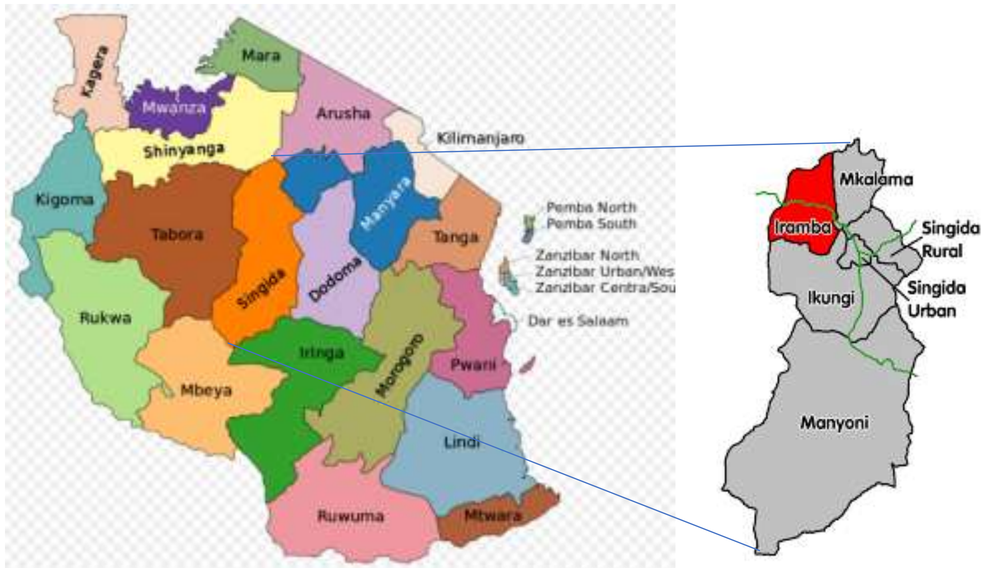

Figure 1. Location of Iramba district in Tanzania.
Source: Authors

preservative, colour maintainer, and medicine (Duerst, 2019; Weremfo, 2019). Salt production across the world varies from place to place.

While in the developed countries, salt producers are likely to be medium and large-scale companies, in developing countries the majority are micro and small-scale producers without right knowledge and equipment. The micro-scale producers use traditional techniques (Kam, 2017; Muhandhis et al., 2020) which are inefficient and may compromise the quality and safety of salt.

Salt is distinguished according to its colour from white, pink, and red to black (Helmi and Sasoka, 2018). Variation of salt chemical compositions gives different salt colour and tastes (Carapeto et al., 2018). There are three methods (that is, conventional, solar evaporation and solution mining) of salt production categories based on the method of salt recovery. Conventional underground or rock salt mining is carried out by drilling and blasting to remove solid salt. Solar evaporation is the use of the sun to evaporate saline water (sea or lake) in special ponds to produce salt crystals that will be harvested mechanically. Solution mining involves underground brine pumping filtration, mechanical evaporation by steam-powered multiple effects or an electric-powered vapor compressor to form salt crystals (Syafii et al., 2019; Muhandhis et al., 2020).

Due to the fact that majority of salt producers in developing countries including Tanzania are micro-scale, salt production has been practiced seasonally as it is weather dependent. Societies living around the salt mines are eventually engaged in salt production (Ba et al., 2020). However, women are the key players in salt processing at micro- and small-scale levels (Iwuchukwu et al., 2021).

As compared to medium and large-scale companies, small and micro-scale companies receive inadequate control and monitoring by the food control authorities (Kussaga, 2015). Inadequate control and monitoring indicate such production units produce inconsistent quality and safe salt (Assey et al., 2009; Syafii et al., 2019). Although salt iodization/fortification with potassium iodate (KIO3) or iodide (KI) is mandatory in Tanzania (URT, 2014; TFNC, 2015; EAS, 2019), majority of micro and small-scale companies do not fortify their salt. This indicates that the public is most probably exposed to non-iodate salts.

Therefore, this study aims to assess the processing and handling practices of salt by small-scale producers at Nkonkilangi.

MATERIALS AND METHODS

The study location

The study was conducted in Nkonkilangi village, Iramba District in Singida Region, Tanzania. The village hosts several micro-and small-scale salt producers in the region, which meets the needs for this study. Iramba District (Figure 1) lies between latitudes 4º to 4º.3º South and longitudes 34º to 35° east. The district covers 4,549.40 square km with a population of 255,373 (URT, 2012). It is bordered by Shinyanga Rural and Meatu districts in the north, Ikungi District in the south, Igunga district in the west and Mkalama district in the east. The district is semi-arid with an extended dry season of seven to eight months (i.e., April to early November) and an annual rainfall of 600 mm to 800 mm (URT, 2012).

Study population (small-scale salt producers) and sample size

The study location had a total of 100 small-scale salt producers.

However, due to financial and time constraints, it was not possible to assess all producers. Therefore, a convenient sample was constituted. The sample size was calculated according to Morris (2004) equation as follows:

$$n = \frac{NZ^2pq}{(E^2(N-1) + Z^2pq)}$$

Where, n is required sample size, population size (N)=100, confidence level (z) =2.58, error (E) = 0.01, population proportions (p and q) each = 0.05 was applied for unknown population proportion. By substituting values of each parameter in the equation:

The sample size $n = \frac{100 \times 2.58^2 \times 0.05 \times 0.05}{(0.01^2 \times (100-1) + 2.58^2 \times 0.05 \times 0.05)} = 63$

Sampling

The simple random sampling technique was used to select 63 participants from the study population of 100 small-scale salt producers. This was simply done by tacking a hundred pieces of paper, out of which 63 pieces were written OK and 27 were labelled NO. The pieces of paper were properly folded, mixed up and put in a bowl. Then, each producer was requested to pick one of the folded papers from the bowl. Producers who picked a folded paper labelled OK were included in the study, whereas those who picked NO were excluded.

Assessment of salt processing and handling method

Scheduled interviews using a questionnaire uploaded in a mobile-phone with help of KoBo Collect software were conducted to assess processing method, soil and water ratios used, filtration, evaporation, drying, production batches, daily production capacity, packaging, storage, type of water used, equipment cleanliness, quality assessment, processing knowledge and skills and availability of toilets. The face-to-face interviews took at least 30 min. The questionnaires were anonymously coded from number 1 to 63.

Statistical analysis

Data collected were downloaded in computer Microsoft excel form and analysed by statistical software International Business Machine (IBM) SPSS statistics ver. 20. Descriptive statistics were performed to obtain frequency, mean, range and percentages.

RESULTS AND DISCUSSION

Characteristics of small-scale salt producers

The salt producers at Nkonkilangi village were all women (100%), whose majority were married (77.8%), primary education holders (63.5%) and aged between 20 and 60 years (90.5%, Table 1). Previous studies in Tanzania and Nigeria also observed women as dominant in small-scale salt production (Assey et al., 2009; Iwuchukwu et al., 2021).

The nature of salt production activities which is mainly cooking could be a limiting factor for men. In most African societies, cooking activities are commonly done by women (Iwuchukwu et al., 2021).

Despite the fact that salt production is a laborious job which would be best suited for young people, 9.5% of processors were over the age of 60 (Table 1). Likewise, study in Guinea also found that salt production was dominated by the younger generation (Balde et al., 2013). Involvement of old people in salt production facilitated the transfer of the traditional processing technology to younger generation.

Although, majority (63.5%, Table 1) of producers had primary level education more than one-third (34.9%) had informal education). The salt production activity in the study area used traditional knowledge that does not require any further training. Old age salt producers conduct the on-job training to younger ones. Long-time schooling could be among the reasons people in Nkonkilangi forego school for salt production. A study in India also observed that majority of salt producers have limited skills with low or no formal education (Bhattacharya et al., 2018). Moreover, a significant number (66.7%) have never attended any training on food processing or food hygiene.

Likewise, Amadu (2019) reported lack of formal training of salt producers in Ghana. Lack of food hygiene training suggests that salt could be inappropriately handled and compromises its quality. It may further limit the adoption of new and improved production technologies. This study also observed that salt production at Nkonkilangi is weather dependent. During the rainy season, producers shift to other economic activities like farming (92.1%) business (3.2%) and mineral mining (4.7%). Unavailability of cooking shelters and storage facilities limit salt production capacity during the rainy season. This does not only affect availability but also price of salt.

Salt production process

All producers (100%) at Nkonkilangi use traditional salt processing method. The method involves several steps namely, mobilisation of raw materials, blending of raw materials, addition of water, filtration, concentration, conditioning, packaging and storage (Figure 2). The next sub-sections provide description of each process step.

Raw materials

The major raw materials used to produce salt are soils and water (Figure 2). Physical observation and explanation by salt producers revealed that traditionally Nyiramba tribe assigned different names to soil used for salt production. The traditional names given to soil include; *Nkuluse* (red silt soil), *mbuga* (dark pack soil) and *sepa* (stacked soil filter residues), or *nkoko* (top soil crust)]. According to experienced salt processors, each soil has different properties and serves a specific function in salt production. Both *nkoko and sepa* aid salt particle

Table 1. Characteristics of salt producers at Nkonkilangi.

Parameter	Frequency (n=63)	(%)
What is your sex?		
Male	0	0.0
Female	63	100.0
What is your marital status?		
Divorced	2	3.2
Married	49	77.8
Single	2	3.2
Widow	10	15.9
What is your age group?		
20-30	13	20.6
31-40	19	30.2
41-50	16	25.4
51-60	9	14.3
Above 60	6	9.5
What is your level of education?		
Informal	22	34.9
Primary	40	63.5
Secondary	1	1.6
Besides salt processing, what other economic activities are you involved		
Business	2	3.2
Farmer	58	92.1
Others	3	4.8
Have you attended any food/salt processing training?		
No	42	66.7
Yes	21	33.3

Source: Authors

size reduction when any one of them is used at the recommended quantity. The ratios used are 1 volume (33.3%) for *nkoko* or *sepa* by 66.6% of mixture of 1 volume of *Nkuluse* and 1 volume of *mbuga.* However, when used in excess could increase foam formation during boiling. *Sepa* is the residue soil after the salt filtration process; it is heaped up to make a protective wall against the wind at the salt production site. A quarter volume of the soil mixture used is *Mbuga* which whitens the final produced salt. Excessive use of *Mbuga* reduces the quantity of salt. *Nkuluse* is used to increase salt quantity. If one of the soil material types is missed, it limits salt production quantity and quality. The chemical reactions occur when Na_2SO_4-rich soil is mixed with $CaCl_2$-rich soil in the presence of water to form NaCl (Li et al., 2021).

The quantity of NaCl formation is determined by proper soil mixing ratios (Li et al., 2021). Although soil has several mineral matters that can contaminate the salt and render it unsafe for human consumption, the soil colour at dry moisture content predicts the potential contaminants (Vodyanitskii and Savichev, 2017). For instance; *Mbuga* (dark pack soil) is associated with high levels of organic compounds while *nkoko (top soil crust)* has high levels of binding agents such as organih c matter, liming materials (calcium carbonate). *Nkuluse* (red soil) is rich in non-soluble materials (iron, aluminium, organic matter, Magnesium, lime, potash, phosphorus and nitrogen (Tamfuh et al., 2018; Li et al., 2021). *Sepa* (*stacked soil filter residue*) *is* residue soil mix of *nkoko, nkuluse, and mbuga,* henceforth has what the three soils have.

Water is used as dissolution medium of soil mixture to make salt. The salt production area has two types of water sources; hot spring and open stream water. As compared to hot spring water, stream water is susceptible to physical contamination. The hot spring water is preferred by the majority of producers (87.5%) as it is regarded as clean and has been used traditionally to make salt.

However, despite such a belief, the readily available water in production areas would be more preferred and used. Therefore, salt miners along the sea would use sea water, whereas those along the lakes would go for lake water to produce salt (Iñiguez et al., 2017).

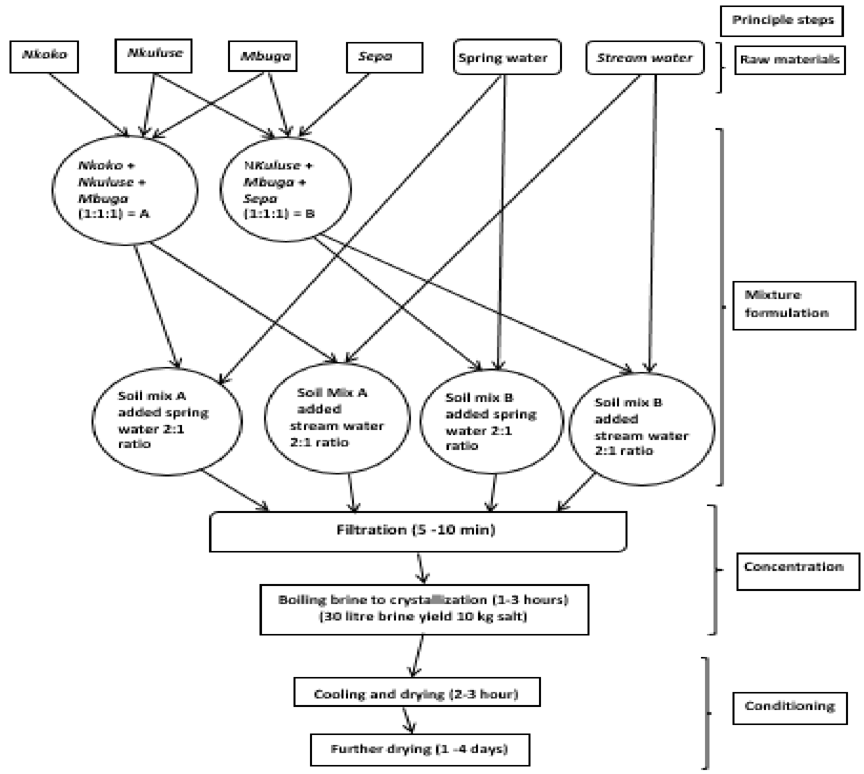

Figure 2. Flow diagram of salt production.
Source: Authors

Preparation of soil mixture

Producers mix at least three types of soils (*nkuluse, mbuga and sepa,* or *nkoko*) in a ratio of 1:1:1(v/v/v) to formulate soil mix A or B (Table 2; Figure 2). However, some slight differences in soil ratios used are likely, as the ratio determines quality of salt (Li et al., 2021). The ratios used are sometimes kept confidential. Some slight differences in soil ratios used are likely to cause salt quality discrepancy among producers.

Dissolution of salt components from the soil (Leaching)

Salt components are dissolved from the soil mixture by using hot spring or stream water. Normally, water enables soil elements to react to different compounds including NaCl (Li et al., 2021). The soil-water ratios commonly used by salt producers are either 2:1 (55.6%) or 1:1 (28.6%, Table 2). Normally water is poured on the mixture of soil placed in perforated clay pots and allowed to percolate. As it percolates, it dissolves water-soluble materials from the soil mixture. The amount of water used determines the concentration of the leach (that is, the brine). Before, the soil mix is poured into pots, a net at the bottom of the pots is properly laid out and clean river sand is put on top of the laid net. Then, the soil mixture in 20 litres bucket is placed on top of that river sand and about 10 litre water is discharged from the top of soil through the leaching pot. The sand and nets aid the filtration process.

Brine filtration

Filtration of the soil leach aims to remove impurities from the brine. As the brine percolates through the soil and sand in the perforated leaching clay pots filtration occurs. The soil and sand provide the same filtration mechanism as observed in sand water filters (Ji et al., 2022).

Majority (65.1%) do filtration more than one round; after the first round the filtrate is poured back on the perforated pot to remove further the contaminants and get a clear filtrate (Table 2). The filtration process conducted in the study area resembled the Benue trough in Nigeria; which also uses perforated clay pots to filter saline (Tijani and Loehnert, 2004). The colour of the salt reflects the efficiency of the filtration process; the whiter the salt the lesser is its impurities.

Salt concentration

Salt concentration involves boiling of the brine to make crystals. It is done through the process known as

Table 2. Salt production.

Parameter	Frequency (n=63)	(%)
What soil and water ratios do you use?		
1:1	18	28.6
1:2	2	3.2
2:1	35	55.6
Others	8	12.7
What type of water is used in salt processing?		
Any water	2	3.2
Hot spring water	54	85.7
stream water	7	11.1
How many times filtration is done?		
Once	22	34.9
Twice	41	65.1
Do you know any loses occurring in the processing		
No	54	85.7
Yes	9	14.3
With what material do you use in stirring salt during boiling?		
Piece of gourd	31	49.2
Plastic	30	47.6
Wood	2	3.2
How long do you evaporate brine for salt recovery?		
< 1 h	8	12.7
1 -2 h	40	63.5
2-3 h	14	22.2
> 3 h	1	1.6
How long do your drying salt before selling?		
One day	3	4.8
Two days	1	1.6
Three days	52	82.5
Four days	7	11.1
How many brine batches do you process per day?		
Three	2	3.2
Four	22	34.9
Five	39	61.9
How many kilogrammes of salt do you produce day?		
180	1	1.6
120	4	6.3
100	30	47.6
80	19	30.2
60	9	14.3
Do you think losses occur in the process?		
No	54	85.7
Yes	9	14.3

Source: Authors

crystallisation. Crystallisation is the formation of salt crystals from the brine. The crystallisation process involves boiling of salt to evaporate water. It was observed that majority of the producers (63.5%) boil the

Table 3. Salt iodization.

Parameter	Frequency (n=63)	(%)
Do you know the salt iodization process or KI?		
Don't know the process	51	81.0
Knows the process	12	19.0
Do you fortify salt with iodate (KI)?		
No	63	100
Yes	0	0
Why don't you fortify the salt?		
Belief that inhered salt from ancestral spirits has enough iodine.	2	3.2
Customers don't prefer off flavour and yellow colour of iodized salt taste foods	1	1.6
Both customers dislike fortified salt off flavour and yellow colour in food and belief that iodine is naturally present in Nkonkilangi's salt	1	1.6
I don't know	17	27.0
KI is not available to fortify salt	14	22.2
Naturally present in salt	27	42.9
Salt loses its white colour	1	1.6
Do you know that selling unfortified salt is criminal?		
No	50	79.4
Yes	13	20.6
What is the importance of KI?		
I don't know	57	90.5
Prevent goitre	1	1.6
To add value	1	1.6
Improve child's brain prevent goitre	1	1.6
Improve child's brain prevent goitre to add value	3	4.8

Source: Authors

brine for 1-2 h (Table 2). Although heating could be done by electricity, solar energy or biogas, all producers at the study site use firewood stoves. Prolonged use of firewood as source of energy may affect salt producers' health (blindness, red-eyes and coughing) and cause environment pollution and degradation (Mhache, 2021). Boiling is normally done in batches (1-5 batches/day); usually, three buckets of brine may produce 1 bucket (20 kg) of salt. Previous studies also observed that brine boiling can take about 1½ to 2 h (Connah et al., 1990). Traditional processing method (filtration and boiling) limits the salt production quantity and quality. The introduction of solar dryers reduces firewood consumption thus giving environment protection and minimizes salt iodine volatility.

Salt conditioning

Salt conditioning involves cooling, drying and/or fortification with iodine to produce salt of the recommended standard. In Nkonkilangi salt cooling is followed just after salt concentration (Figure 2). Cooling and preliminary drying are done for 2-3 h by transferring salt to a net sheet placed on top of the inclined ground. The cooled salt is transported to the producers' households. Then, secondary drying is done for up to four days outside the producers' home, under the sun. This is a critical step for salt safety, as inadequate and long drying periods may introduce various health hazards to salt. Moreover, sun drying has some limitations particularly during rainy and cloudy days and may result in iodine loss (Etesin et al., 2017). Iodine is heat labile (Assey et al., 2009), hence, the significant amount of natural occurring iodine is vulnerable to boiling for salt recovery and conditioning by sun drying. Iodine fortification is necessary to compensate for the processing losses and top up to Tanzanian standards for the health of consumers.

Salt fortification

Despite the fact that salt iodisation has been mandatory for a long time in Tanzania (URT, 1994), none of the salt producers at Nkonkilangi did fortification (Table 3).

Table 4. Packaging storage and marketing.

Parameter	Frequency (n=63)	Percent
What type of packaging material do you use?		
woven polyethylene	63	100.0
Bottle	0	0.0
Paper bags	0	0.0
Jute sucks	0	0.0
Where do you store the produced salt?		
Dedicated store inside the houses	5	8.0
Outside without shade	58	92.0
Where do you sell salt?		
Singida, Shinyanga, Tabora, Simiyu and Mwanza	1	1.6
Singida, Shinyanga, Tabora	62	98.4
What do you do with salt rejected/ returned by the customer?		
Receive and keep for sale	44	69.9
Refuse to receive it	19	30.1
Receive and destroy	0	0.0
What is the price of salt?		
Dry season 500/tin	63	100.0
Wet season 1000/tin	63	100.0

Source: Authors

Majority (81%) of salt producers have never heard of salt fortification. They do not know whether selling of non-iodised salt is illegal (79.4%) and know nothing about the nutritional importance of iodised salt (90.5%, Table 3). On the contrary, previous studies in other countries like Ghana reported that the salt producers iodize salt before selling (Amadu, 2019). Besides lack of awareness, some salt producers (42.9%) at Nkonkilangi village believed that the salt produced at their area has enough natural iodine (Table 3). Others claim that some consumers dislike the flavour of food prepared with iodized salt. Moreover, some say the loss of natural colour of foods prepared with iodized salt is the stumbling blocks to adaptation of salt iodisation. The outcome of such claims and beliefs is the continuation of consumption of non-iodised salt within the area and beyond. As compared to urban areas, people in rural areas have limited opportunities to eat out of their homes. So, if a family depends on such salts, they may consume non-iodised salts throughout their lives which increase chance of health implications (Ba et al., 2020). However, previous studies did not find any sensory obstacle to food products processed using iodized table salt in Finland (Greis et al., 2018). Contrary to the above 22% of producers reported the major limiting factors to salt fortification (Table 3).

A similar study in Ethiopia identified lack of KI as among the influencing factors of salt iodine fortification (Desta et al., 2019). Furthermore, majority (79.4%) of salt producers at Nkonkilangi do not know that it is illegal to sell non-iodized salt in Tanzanian and know nothing about the importance of using iodised salt to the human body (90.5%). These results show inadequate promotion campaign regarding the utilisation of iodised salt in Tanzania. Strategies to increase awareness and adoption of salt fortification by salt producers at Nkonkilangi and other areas are therefore very essential.

Packaging, storage and marketing of salt

All (100%) salt producers observed in this study package salt in woven polyethylene bags (Table 4). Likewise, a study in Ghana found that polyethylene bags were the major packaging materials for the small-scale producers (Amadu, 2019).

Woven polythene bags used were porous and allowed entrance of dust and other contaminants. The drying methods used by producers are inadequate to properly dry the salt. So woven bags may allow water to squeeze out the salt even during storage. The producers have no proper stores for their salt; it is often stored outside their houses without shade (92%).

Likewise, salt producers in Ghana store salt under inadequate conditions (Amadu, 2019). Improper storage of salt may expose salt to sunlight, allow pickup of moisture and contaminate it with other hazards. According to CAC (2001) salt should not be exposed to rain, excessive humidity or direct sunlight at any stage of

Table 5. Quality assessment parameters.

Parameter	Frequency (n=63)	Percent
With what means do you clean equipment?		
Washing with water, brush and detergent	1	1.6
Washing with water and brush	7	11.1
Washing water only	43	68.3
Others	12	19.0
How many times do you clean the equipment?		
After two days	1	1.6
Daily (before and after use)	41	65.1
Don't wash	7	11.1
Monthly	1	1.6
Weekly	13	20.6
What of the following contaminants do you find in salt?		
Animal dropping(dung), Soil, plastic, Petrol/Diesel	3	4.8
Not aware of salt contaminants	1	1.6
Plastics only	3	4.8
Plastics, Sand only	2	3.2
Plastics, Sand, Animal dropping(dung)	1	1.6
Sand only	53	84.1
With what material do you use in stirring salt during boiling?		
Piece of gourd	31	49.2
Plastic	30	47.6
Wood	2	3.2

Source: Authors

storage.

The study also observed that salt was sold within the region (i.e., Singida) and neighbouring regions of Shinyanga and Tabora. Salt producers (69.9%) receive and compensate the customers when they return unfit salt for human consumption. The price of salt ranges from TZS 500 during the dry season to TZS 1000/l tin (≈ Kilogram) in the rainy season. Likewise, in Indonesia, it is reported that the price of salt is higher during the rainy season (Rochwulaningsih, 2018).

Hygiene/ sanitation/ cleanliness of equipment

More than 68.3% of salt producers do not use detergents to clean and wash their processing equipment daily (65.1%). Some producers (11.1%) do not clean their equipment at all. Although salt is a preservative that inhibits the growth of microorganisms, if the equipment is not properly cleaned it may corrode and contaminate salt with other foreign matters leading to salt colour changes. Studies in Italy and Croatia reported changes in salt colour due to mud, clay macro plastics, micro-plastic and litter contaminants (Helmi and Sasoka, 2018; Renzi and Blašković, 2018). This was contributed by low quality small-scale salt products due to poor equipment and less effective purification process as well as occurrence of floods. Table 5 shows the quality assessment parameters.

The use of woven polyethylene bags by all (100%) small-scale salt producers for packing salt did not restrict contamination and loss of iodine. High-density polyethylene bags or paper with plastic lining are better in iodine retention than woven polyethylene bags (Sarkar and Aparna, 2020). A practice of storing salt outside without any shade by the majority (92%) of small-scale salt producers accelerates the loss of iodine and exposes the salt to contamination. This has implications to salt iodine content and accessibility for consumption to be low.

Furthermore, the contaminants of salt identified by the producers were mainly sand (84.1%). Other contaminants like animal dropping, plastic, petrol or diesel were observed by very few producers. It also indicates that the producers are not aware of the sources of some hazards like microplastics. A significant proportion of producers (47.6%) use plastic and broken pieces of guard to steer salt during cooking. Grazing animals were observed in the salt production areas. Most likely, microplastics and organic compounds were among the salt contaminants. Previous studies observed microplastics in table salts produced from sea, lake and well water as well as rock (Iñiguez et al., 2017). The occurrence of microplastics in rock/well salts implied the introduction of microplastics during the production stages.

CONCLUSIONS AND RECOMMENDATIONS

Small-scale salt production in Tanzania is generally dominated by people with inadequate knowledge of food handling which makes the quality of salt to be questionable. Small-scale processors use traditional techniques to produce salt. The use of traditional techniques, and lack of proper packaging materials associated with inadequate storage conditions indicate that cross-contamination is inevitable. Although salt fortification is mandatory, small-scale producers are not aware. There is also a lack of control and monitoring of such smaller processing units to ensure the quality and safety of salt. Taking into account the importance of universal salt iodisation, deliberate efforts are required to control and monitor small-scale salt producers across the country. Salt fortification should be equally regulated/ implemented regardless of the size of production. Training is recommended to all actors along the salt value chain to ensure the quality and safety salt.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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