

Article

Handling Practices of Folded Vermicelli by Small-scale Processors in Tanga City, Tanzania

Lucas Mbuga^{1,2}, Davis Naboth Chaula², Jamal Bakari Kussaga^{2,*}

¹ Department of Agricultural Training and Research, Ministry of Agriculture, *Mji wa Serikali-Mtumba*, P. O. Box 2182, Dodoma, Tanzania

² Department of Food Science and Agro-processing, School of Engineering and Technology, Sokoine University of Agriculture, P. O. Box 3019, *Chuo Kikuu*, Morogoro, Tanzania

*Correspondence: Lucas Mbuga (lucasmbuga02@gmail.com)

Abstract: This study assessed the handling and processing practices of 30 small-scale folded vermicelli processors in Tanga, specifically in urban areas of Tanga City, Tanzania. However, the micro- and small-scale processors were producing in unhygienic way because they are lacking facilities and equipment to process and handle the product hygienically. Multistage sampling design was adopted for this study and face-to-face interviews were conducted to collect data from all processing units through nine streets using semi-structured questionnaires and observation checklists. Data were analyzed using Statistical Package for Social Sciences, where the statistics aspect was determined from the results obtained. The processors found across various streets (ranging from 3.3% in Kwaminchi Street to 23.3% in Mabawa Street), exhibited diverse demographics, with 53.3% being owner-operators and 40% and 6.7% in labourer and supervisor roles, respectively. A significant portion (53.3%) had 1-3 years of experience, and a small portion (10%) attended formal training in pasta processing. Despite 73.3% possessing food manufacturing licenses, many were unfamiliar with legal requirements, lacking documentation and standardized processes, raising concerns about food safety. Raw materials were sourced locally, but 56.7% lacked storage facilities. Hygienic practices varied, with 43.3% undergoing periodic medical check-ups, 70% using protective gear, and 60% had hand washing facilities. Sun drying was the sole method employed, with 86.7% placed drying trays on rooftops. Packaging practices raised concerns, as 93.3% reused woven polypropylene bags, potentially impacting product quality. Awareness of aflatoxin and its health implications was lacking in 90% of the processors. Overall, the study highlighted gaps in awareness, training, and adherence to standards among processors, posing potential risks to food safety and quality. Encourage them to adhere with Tanzania Bureau of Standards requirements and formalize their quality control practices.

How to cite this paper:

Mbuga, L., Chaula, D. N., & Kussaga, J. B. (2024). Handling Practices of Folded Vermicelli by Small-scale Processors in Tanga City, Tanzania. *Universal Journal of Food Science and Technology*, 2(1), 29–44. Retrieved from <https://www.scipublications.com/journal/index.php/ujfst/article/view/1021>

Received: May 11, 2024

Revised: July 26, 2024

Accepted: August 8, 2024

Published: August 12, 2024

Keywords: Processing Units; Spaghetti; Processor's Awareness; Aflatoxin



Copyright: © 2024 by the authors. Submitted for possible open-access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Folded vermicelli is a traditional type of pasta which is commonly consumed in Tanzania. The most famous region in pasta consumption, especially the folded vermicelli is Tanga. The Arab merchants introduced Italian pasta in various countries including Tanzania [12]. Pasta consumption has become a tradition, especially in coastal areas like Tanga. However, the consumption is relatively higher during the Holy month of Ramadan, when Muslims are fasting. Although there are few large-scale pasta processing companies in the country, the micro- and small-scale units in Tanga are the major producers of folded vermicelli. The production of folded vermicelli requires wheat flour and water as the main raw materials [2]. However, the quality and safety of the final

product depend on the raw materials, processing techniques and handling practices [52]. However, the micro- and small-scale companies lack facilities and equipment to process and handle the product in a hygienic way. Inadequate personal hygiene and working environment cleanliness are regarded as major routes of contamination [21,42].

Despite the fact that the production process of folded vermicelli is a thermal process involving steaming (pre-cooking) which kills most microorganisms, drying process and handling practices of finished products can pose a risk of cross contamination. The processors use open sun drying method, whereby uncovered folded vermicelli in trays is placed on rooftops and/or on ground/floors for two days. They lack equipment and tools to assess the moisture content in dried products. Their products may be packed while are not properly dried either in new or used woven polypropylene bags, often without any cleaning intervention. These practices may create a potential route of products contamination with various hazards [48]. If folded vermicelli are dried for long time or packed while not well dried, there is a potential risk of growth of mycotoxigenic fungi that may also produce mycotoxins. Several studies have reported the presence of aflatoxins in wheat and its products like pasta, where aflatoxin B₁ (AFB₁) was reported in 47.8% of studies in the last five years, between 2015 to 2020 [41, 45, 47, 56].

Even though the fact that folded vermicelli processors are small-scale, indeed they must ensure the safety of food products to prevent food borne diseases [53]. Although some studies have been conducted to assess handling practices in fish [29] and dairy [30] processing companies little has been done in pasta processing companies. Therefore, this study intend to assess the handling and processing practices in folded vermicelli by small-scale processors in Tanga City. The findings from this study will be useful to food control authorities and other stakeholders to set up control strategies to small-scale processors in the country.

2. Materials and Methods

2.1. Description of the Study Area

The study was conducted in Tanga City, in Tanga District (Figure 1). Tanga is one of eleven administrative districts of Tanga Region in Tanzania. The district covers an area of 596.5 km² of which includes the historic city of Tanga and the port of Tanga. Geographically, Tanga is located on coordinates: 06°57" south and 37°32" east. Tanga District is bordered to the north by Mkinga District, to the east by the Indian Ocean, to the south and west by Muheza District. It has an average temperature of 24.6°C and 935 mm of rainfall per year, and the area is classified under tropical-climate. The district is the administrative and economic centre of the region. According to the 2022 National Census statistics; the city has a total population of approximately 245,182 people. The district is famous in production and consumption of pasta especially folded vermicelli. Nine streets from nine administrative wards in Tanga City were involved in this study.

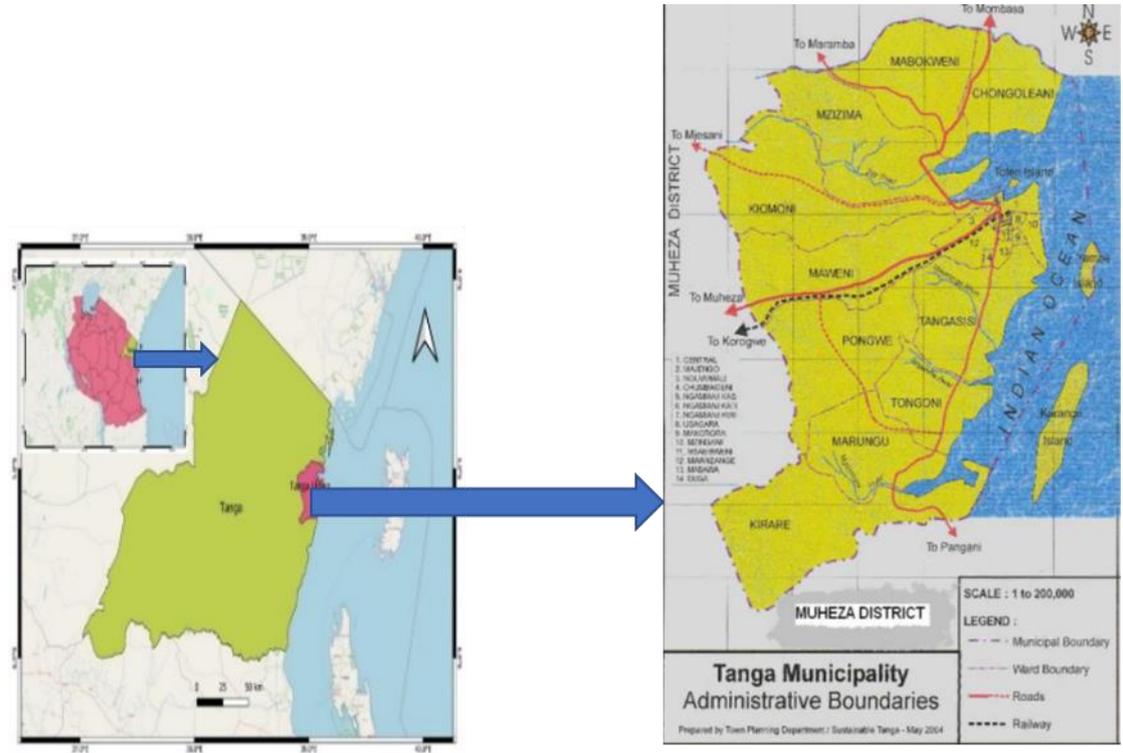


Figure 1. Map of Tanga City showing the study sites where respondents obtained in Tanga District (Source: Authors).

2.2. Sampling Design

Multistage sampling design was implemented in this study [1]. In summary, three divisions (Chumbageni, Ngamiani Kaskazini and Ngamiani Kati) were purposefully selected among the four divisions of Tanga City. Nine administrative wards out of 27 wards, namely, Chumbageni, Duga, Mabawa, Ngamiani Kaskazini, Makorora, Msambweni, Central, Ngamiani Kati and Ngamiani Kusini were also purposefully selected. The wards selected were those with at least one folded vermicelli processing company. Then, all the streets with the folded vermicelli processors were taken from each of the chosen wards, as indicated in the sampling plan (Figure 2). Finally, 30 small-scale processors were selected from each street ($n=30$).

The sample size was estimated by using the Kothari equation [28].

$$n = \frac{Z^2 * P(1-P)}{e^2} \quad (1)$$

Where; n = the required sample size, Z = the level of statistically significant at 95% confidence interval = 1.96, P = the percentage occurrence of a state or condition = 5%, and e = the percentage maximum marginal error required = $\pm 8\%$ for this study.

$$n = \frac{(1.96)^2 * 0.05(1-0.05)}{(0.08)^2} = 28.5118... \\ \approx 30 \text{ respondents}$$

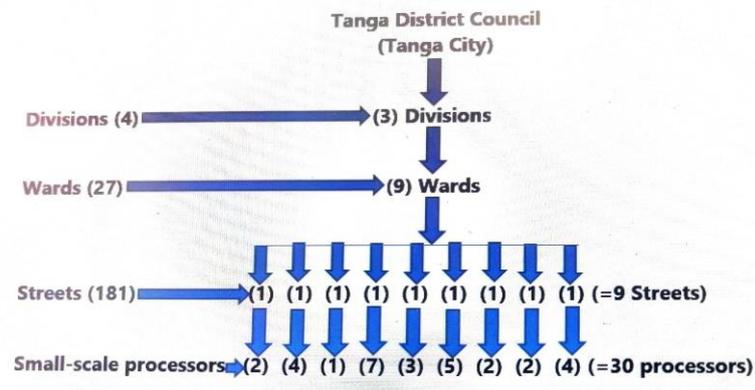


Figure 2. A sampling plan for small-scale processors obtained from streets of Magomeni, Central, Kwaminchi, Mabawa, Makorora Kati, Msambweni, Swahili, Msikiti and Azimio in Tanga City (Source: Authors).

2.3. Survey of small-scale folded vermicelli processor's awareness on handling and processing practices

Face-to-face interviews were conducted to assess the handling and processing practices through nine streets. Information was collected from each respondent, a total of 30 respondents were interviewed from 30 small-scale folded vermicelli processors using a semi-structured questionnaire and the observation checklists. Information was collected from each company. All processing units in Tanga City were involved in this research study.

2.4. Statistical Data Analysis

Data from the questionnaires were processed by editing, coding and analyzing by using a Statistical Package for Social Sciences (IBM SPSS Version 25, Chicago, IL, USA). Descriptive statistic was employed. The data were then presented as frequencies and percentages.

3. Results and Discussion

3.1. Demographic characteristics of respondents

The majority (70%) of respondents were male, indicating a gender disparity in the industry (Table 1). This could be attributed to the nature of the business and associated activities (lifting, mixing/molding), which favoured masculine. These findings contradict those of earlier studies where Hassan and Fweja [20] report that 67.5% of the food street vendors are females. Likewise, the findings from the study by Rabia [43] reveal that 74.8% of the processors are males, and Masunzu [34] reports that 80% are males. In terms of age distribution, a significant portion of processors fell in the 31-40 age group (43.3%), followed by those above 50 (26.7%). This data indicated a diverse age group within the processing industry, with a considerable number of more experienced individuals. With regards to education level, the majority of processors had secondary (43.3%), followed by primary school (40%) education. These findings agree with Ali [3], who reveal that the majority (61.5%) of respondents have accomplished secondary school. However, they contrast with the findings reported by Chijoriga [11], which highlight that 64% of small and micro enterprises (SMEs) have vocational education in food processing. It was also observed that the businesses were predominantly dominated by owners (53.3%). The processing seemed to be mostly ran by the owners themselves, with few positions for labourers (40%) and supervisors (6.7%). This could impact the overall management and quality control within the businesses. The majority of processors (53.3%) had 1-3 years of

experience in the industry, while just 16.7% had more than 7 years, demonstrating a range of skill levels. Experience adds value to the work and can determine SMEs ability to upgrade [31]. A relatively small portion (10%) of processors were attended a training course, specifically a seminar on pasta production held at Zanzibar for one week. They had acquired additional knowledge and skills relevant to the production of folded vermicelli. According to Osei and Anfu [40], point out that due to infrastructure problems and a lack of knowledge, small food enterprises have difficulty implementing food safety management systems. All owners and employees working in food premises, including temporary employees, should be trained on the basics of food safety principles and practices required to prevent contamination [14,15].

Table 1. Demographic characteristics of respondents (n = 30)

Variable	Respondents/categories	Frequency	Percent (%)
Gender	Male	21	70.0
	Female	9	30.0
Age (in years)	< 18	0	0.0
	18 – 30	5	16.7
	31 – 40	13	43.3
	41 – 50	4	13.3
	> 50	8	26.7
Education level	Non formal	3	10.0
	Primary	12	40.0
	Secondary	13	43.3
	Vocational Training	2	6.7
Work position	Owner	16	53.3
	Supervisor	2	6.7
	Labourer	12	40.0
Work experience (in years)	< 1	2	6.7
	1 – 3	16	53.3
	4 – 6	7	23.3
	> 7	5	16.7
Training course	Yes	3	10.0
	No	27	90.0

Key: <: less than; >: greater than; Source: (Author survey, 2023).

3.2. Characteristics of the small-scale processing units

The distribution of processors across different streets in the urban areas of Tanga City was varied. The proportions of processors in each street were Mabawa (23.3%), Msambweni (16.7%), Central (13.3%), and Azimio (13.3%) (Table 2). This variation could have been due to easy accessibility to resources, market demand, and/or historical factors. A significant majority (73.3%) of processors held valid food manufacturing licenses from either the Municipal Council or Tanzania Bureau of Standards (TBS) (formerly, Tanzania Food and Drugs Authority-TFDA), which was crucial for ensuring the safety and quality of the food products they produced. Though, none of the processors had registered their companies, indicating that all were operating informally. This is reliable with a study by Ruteri [44] reveal that micro and small food processors in Tanzania operate in the informal sector, employing labour-intensive methods and utilizing inadequate technologies.

In addition, seventy percent of the processors had fewer than 10 employees, while 30% had between 10 and 49 employees (Table 2). The number of employees depended on the scale of production and the available resources, indicating that they were truly categorized as small-scale entrepreneurs. A significant portion of the companies (73.3%)

were inspected, with 36.7% being inspected three times a year. Company inspections were critical for quality control and ensuring compliance with food safety standards. TBS and government health officers inspected the processor's companies on a number of activities, including the general cleanliness of premises, facilities and personal hygiene, building maintenance and sewerage repair, routine medical check-up, wearing of protective gears and proper uniforms, and business licenses. Processors undergoing inspections have a better understanding of the importance of quality and safety standards in food production [39]. Production frequency varied; 70% processed three days a week, while others operated more frequently as shown in Table 2. Daily production ranged from 1-30 bags for 70% of processors to 31-100 bags for 30%, influenced by equipment, workforce, and market needs. Only one processor achieved high production of about 98 bags per day, indicating advanced resources and high demand.

Table 2. Characteristics of the small-scale processing units

Variable	Respondents/categories	Frequency	Percent (%)
Location (Streets)	Magomeni	2	6.7
	Mabawa	7	23.3
	Azimio	4	13.3
	Swahili	2	6.7
	Msikiti	2	6.7
	Makorora Kati	3	10.0
	Msambweni	5	16.7
	Central	4	13.3
	Kwaminchi	1	3.3
Company registration	No	30	100.0
Food manufacturing license	Yes	22	73.3
	No	8	26.7
Number of employees	< 10	21	70.0
	10 – 49	9	30.0
	> 50	0	0.0
Company inspection	Yes	22	73.3
	No	8	26.7
Inspection frequency (in years)	Twice	7	23.3
	Three times	11	36.7
	> three times	4	13.3
Production frequency per week	7 days	3	10.0
	6 days	6	20.0
	3 days	21	70.0
Quantity produced per day (in bags)	0 – 30	21	70.0
	31 – 100	9	30.0

Key: <: less than; >: greater than; Source: (Author survey, 2023).

3.3. Handling of raw materials

The study showed that all processors sourced their raw materials from local markets, emphasizing quality (90%) in their selection process (Table 3). Though visual checks could identify obvious contaminants like dirt or foreign objects, they cannot detect invisible threats such as bacteria, viruses, or chemical residues [50]. Prioritizing quality over price in raw material selection was a positive practice in food production, as quality raw materials were essential for producing safe and high-quality food products. Price-

conscious decisions may have been a result of cost constraints but could sometimes compromise quality.

Table 3. Handling of raw materials by processors

Variable	Respondents/ categories	Frequency	Percent (%)
Are raw materials purchased from local markets?	Yes	30	100.0
For what factor?	Quality	27	90.0
	Price	3	10.0
Do you have store?	Yes	13	43.3
	No	17	56.7
Is there any spoilage problem for stored raw materials?	Yes	5	16.7
	No	25	83.3
Possible sources of spoilage	Moisture	3	10.0
	Insects/rodent	2	6.7
Is the TUWSSA taken as the source of water (tap water) used?	Yes	30	100.0

Key: TUWSSA: Tanga Urban Water Supply and Sewerage Authority; Source: (Author survey, 2023).

Over half (56.7%) of processors lacked proper storage facilities (Table 3), instead storing raw materials at home or within processing areas. Proper storage is essential for preventing spoilage and maintaining raw material quality, but financial limitations or lack of awareness might hinder the establishment of such facilities [18]. The data showed that only 16.7% of processors reported spoilage problems, with moisture (10%) being a common cause. Effective storage practices are vital for minimizing spoilage and maintaining food safety, as inadequate storage can lead to contamination and health risks [25]. Overall, improving storage conditions could enhance quality and reduce food loss, addressing potential threats to consumer health [4].

3.4. Hygiene and sanitation practices

The study found that only 43.3% of processors underwent periodic medical check-ups (Table 4), possibly due to cost constraints or a lack of awareness regarding their importance. Employees with infectious diseases can contaminate food through direct contact or by tainting surfaces, utensils, and equipment, thereby increasing the risk of foodborne illnesses [13]. A small portion (20%) had designated changing or dressing rooms, which are crucial for preventing contamination by ensuring work clothes remain clean. The availability of these facilities might be influenced by space constraints or awareness of their importance. About 70% of processors wore protective gear such as aprons, gloves, and hairnets, which is essential for maintaining hygiene and preventing contamination of food [49]. More than half (60%) of processors had hand washing facilities, which are essential for preventing the spread of pathogens. Hand washing was performed after key activities such as using the toilet (46.7%), shaking hands (16.7%), and blowing the nose (23.3%), which aligns with good hygienic practices to minimize contamination risks.

Processors used coconut or cooking oil for machine cleaning (Table 4), which prevents rust and ensures smooth operation, but none used additional water treatment methods, possibly relying on the quality of their tap water. For waste disposal, 86.7% used communal municipal collection points, and 13.3% burned waste, demonstrating efforts to maintain cleanliness and prevent environmental contamination [22].

Table 4. Hygiene and sanitation practices of the processors

Variable	Respondents/ categories	Frequency	Percent (%)
Is the periodical medical check-up conducted?	Yes	13	43.3

	No	17	56.7
Do you have changing/dressing room?	Yes	6	20.0
	No	24	80.0
Do you wear the protective gears?	Yes	21	70.0
	No	9	30.0
Do you have toilet(s)?	Yes	30	100.0
Do you have hand washing facilities?	Yes	18	60.0
	No	12	40.0
At what time do you wash your hands?	After visiting toilets	14	46.7
	After hand shaking with others	5	16.7
	After blowing nose	7	23.3
	Before starting processing	4	13.3
Is unnecessary foot traffic not allowed in processing areas?	Yes	3	10.0
	No	27	90.0
Do you clean machines?	Yes	30	100.0
Is coconut/cooking oil used for cleaning machines?	Yes	30	100.0
Which water used for cleaning?	Normal potable water	30	100.0
The drying facilities cleaned by	Sweeping with HBBM	4	13.3
	Sweeping with HBB	26	86.7
Do you have any water treatment?	No	30	100.0
How do you dispose your waste?	In communal municipal collection points	26	86.7
	Burn at home waste pit	4	13.3

Key: HBBM: hand broom, brush and mops, HBB: hand broom and brush; Source: (Author survey, 2023).

3.4.1 Manufacturing process of folded vermicelli

Nowadays, pasta is processed by continuous, high-capacity extruders that operate on the auger extrusion principle, combining kneading and extrusion in a single operation [8]. The production of folded vermicelli by small-scale processors in Tanga City involved the following steps:

Mixing and kneading: Wheat flour and water were mixed in precise proportions in a mixer to form a pasta dough. The dough was then kneaded with water at a temperature of 20 to 30°C.

Extrusion: Once the stiff dough was uniformly mixed and formed, it was fed into a sheeter and former machine to create dough plates. These plates were then passed through a die machine under high pressure to produce a wide variety of vermicelli, with the shape and size of the die adjusted accordingly.

Steaming and folding: The sized and shaped vermicelli were placed into pasteurizer tanks/vessels for thermal treatment, typically for 1 to 1½ hours to reach a pre-cooking condition. Most processors used gas combustion to boil water for steam production, although one processor used crude oil combustion, which posed a serious environmental issue with smoke disposal. After steaming, the partially cooked vermicelli were folded into their final shapes (folded vermicelli) and prepared for the drying process. Thermal treatment not only ensures safety by reducing microbial populations and altering the pasta structure through water activity reduction, but it also leads to unwanted modifications [19].

Drying: Special attention is given to the final step of the pasta-making process: the drying step. It is well-known that the drying process gives dry pasta its desired physical

and chemical stability and allows it to have a longer shelf life [10]. The drying time is also crucial, as over-drying can cause the pasta to break down, while drying too slowly increases the risk of spoilage [52]. The formed folded vermicelli were placed on drying trays and then left on rooftops or on the floor/ground for two days, which was sufficient drying time if there was enough sunlight.

Weighing and packaging: The dried folded vermicelli was weighed according to the processor's decision and customer requirements, and then packaged in either new or used woven Polypropylene bags. The packaged folded vermicelli was then ready for sale.

3.5. Processing and drying practices of folded vermicelli

The study revealed that all processors engaged in seasonal and batch production, particularly during the Holy month of Ramadan due to heightened customer demand (Table 5). Some continued production post-Ramadan based on customer orders. All processors employed a semi-automated system, combining manual and machine tasks, which is typical for small-scale food processing due to its affordability and suitability for lower production volumes. However, product quality often varied due to inadequate quality control facilities, a lack of awareness about their importance, and substandard manufacturing practices.

Sun drying was the primary method used for drying folded vermicelli, aligning with finding by Sasongko *et al.* [46] in Indonesia that also highlighted the reliance on sunlight for small to medium enterprises. This method's effectiveness is contingent on weather conditions, which affects drying continuity and vermicelli quality [46]. Most processors (86.7%) dried their product on rooftops, benefiting from direct sunlight and airflow, while 13.3% used both rooftops and the ground due to space limitations. Processors generally did not cover the vermicelli during drying, preferring open-air exposure despite risks of contamination from dust and bird droppings. Drying typically took two days, with an additional day using an expensive charcoal oven if weather conditions were poor. Dryness was checked manually by inserting a finger into the folded vermicelli, as no moisture meters were used (Table 5). Manual inspection by touch is a practical and effective method commonly used in food processing to determine the dryness of pasta especially folded vermicelli [55].

The main challenge faced by processors was the laborious task of moving trays to and from rooftops (43.3%), especially in adverse weather, reflecting the constraints of limited resources and infrastructure (Table 5). Understanding these practices and challenges is essential for enhancing folded vermicelli production efficiency and quality in small-scale operations.

Table 5. Processing and drying practices of folded vermicelli

Variable	Respondents/ categories	Frequency	Percent (%)
Seasonal production	Yes	30	100.0
Processing machines/ work used	Semi-automated machines/ work	30	100.0
Drying method used	Sun drying	30	100.0
	Oven drying	0	0.0
	Cabinet dryer	0	0.0
Where do you put it when dries on the sun?	On roof tops	26	86.7
	On rooftops and on ground/ floor	4	13.3
Do you cover folded vermicelli when drying?	No	30	100.0
Drying period	Two days	30	100.0
Dryness identification	By inserting a finger inside a folded vermicelli	30	100.0

Challenges experienced in drying process	By using a moisture meter	0	0.0
	Lack of cover-materials when drying	5	16.7
	Hard work to put trays on roof tops	13	43.3
	Lack of dryer	3	10.0
	Tedious work in monitoring activity	7	23.3
	Expensive when use of oven charcoal drier	2	6.7

Source: (Author survey, 2023).

3.6. Quality control of the end products

Despite their extensive experience, none of the processors were familiar with the specific requirements set by the Tanzania Bureau of Standards (TBS) (Table 6). Instead, they relied on common sense to evaluate the quality of their products, such as folded vermicelli, which could pose food safety risks. None of the processors had formal working instructions, operating procedures, or a pasta processing flow chart, relying instead on habitual practices. This lack of formal documentation suggested inconsistent quality control and an increased risk of cross-contamination. Only 23.3% of processors maintained medical examination records for their employees, a situation attributed to the costs of medical exams and insufficient awareness of workplace health and safety requirements. Additionally, none maintained records for cleaning and disinfection schedules, indicating a potential lack of systematic cleaning practices and possibly limited awareness or resources for effective sanitation.

Product safety assurance involves ensuring quality in raw materials and critical processing elements, with validated and monitored processes to uphold food safety [9]. While all processors claimed to use good quality raw materials (Table 6), only 26.7% adhered to Good Hygienic Practices (GHP) and 20% to Good Manufacturing Practices (GMP), suggesting room for improvement in ensuring product consistency and safety [16]. Eight percent of processors did not comply with GMP, risking product quality and safety issues. Packaging and storage practices also needed enhancement. Only 6.7% used new, quality packaging materials, while 93.3% reused woven polypropylene (PP) bags, potentially compromising product quality (Table 6). Approximately 56.7% reported proper storage conditions, which helps maintain product quality. Good raw materials are vital, but inadequate hygiene practices, manufacturing processes, and packaging could lead to contamination and spoilage, particularly in tropical climates like Tanzania.

Table 6. Quality control of the end products

Variable	Respondents/ categories	Frequency	Percent (%)
Do you meet specific requirements as per TBS?	No	30	100.0
Do you have working instructions and operating procedures?	No	30	100.0
Do you have pasta processing flow chart?	No	30	100.0
Do you have medical examination records?	Yes	7	23.3
	No	23	76.7
Do you have cleaning and disinfestation schedule records?	No	30	100.0
Product safety assurance:			
Using good raw materials	Yes	30	100.0
	No	0	0.0
Conduct GHP	Yes	8	26.7

	No	22	73.3
Conduct GMP	Yes	6	20.0
	No	24	80.0
Proper product packaging	Yes	2	6.7
	No	28	93.3
Proper product storage	Yes	17	56.7
	No	13	43.3

Source: (Author survey, 2023).

3.7. Packaging and labeling information of the final products

The study found that all processors engaged in production packaging (Table 7), which is a positive practice. However, none used polyethylene (PE) bags, and the majority (93.3%) reused woven polypropylene (PP) bags, which can lead to contamination and brittleness during handling. Azahar *et al.* [7] observed similar practices among Malay SMEs in Malacca, where inexpensive packaging materials often resulted in poor packaging and labeling. Only 6.7% of processors used new woven PP bags with labels. Food-grade packaging is essential to maintain the hygienic, nutritional, and sensory qualities of pasta products. Bag weights varied: 20% used 12.5 kg bags, 40% used 12 kg bags, 16.7% used 11 kg bags, and 23.3% used 10 kg bags, reflecting market demand and consumer preferences.

Most processors (76.7%) sealed bags with machines to prevent contamination and tampering. Sealing the bags is important to prevent air, moisture, and other external contaminants from entering, which can affect the product's quality [23]. Only 6.7% used product labels, which are vital for providing branding, product details, and instructions, likely due to cost constraints or lack of awareness. Only 6.7% included production and expiry dates, and 3.3% had batch numbers. Proper labeling and batch tracking are crucial for safety, consumer information, and regulatory compliance [17,36].

Table 7. Packaging and labeling information of the final products

Variable	Respondents/ categories	Frequency	Percent (%)
Product packaging	Yes	30	100.0
Type of packaging materials used	New PP bags	2	6.7
	Used PP bags	28	93.3
	Used PE bags	0	00.0
Weight of packaged bag (in kg)	12.5	6	20.0
	12	12	40.0
	11	5	16.7
	10	7	23.3
Sealing of the packaged bags	Yes	23	76.7
	No	7	23.3
Product label	Yes	2	6.7
	No	28	93.3
Production and expiry date	Yes	2	6.7
	No	28	93.3
Batch number	Yes	1	3.3
	No	29	96.7
Manufacture name and contact address	Yes	2	6.7
	No	28	93.3

Source: (Author survey, 2023).

3.8. Storage of final products and market information

Approximately 43.3% of processors had storage facilities (Table 8), either at home or within their processing areas. Adequate storage is vital for maintaining food quality and safety. Limited storage often results in poor ventilation and a dusty environment, which can affect worker health, highlighting the need for better storage solutions [44]. Half (50%) of processors stored products for less than 1 month, 30% for 1 to 3 months, and 20% for 4 to 6 months, with none storing for over 6 months. Shorter storage durations are beneficial for quality and safety. About 16.7% of processors reported spoilage issues, often due to inadequate storage and pest problems [5]. Most products (63.3%) were sold to retailers and individuals, who are the primary customers due to the small-scale nature of the processors. Complaints were received by 46.7% of processors, with the most common issue being product brittleness (26.7%). Few processors (20%) managed returns properly, with some destroying or repurposing them as animal feed. Effective storage and complaint management are crucial for ensuring product quality and safety.

Table 8. Storage of final products and market information

Variable	Respondents/ categories	Frequency	Percent (%)
Do you have store for final products?	Yes	13	43.3
	No	17	56.7
Products stored until next season	Yes	0	0.0
	No	30	100.0
Storage duration (in month)	< 1	15	50.0
	1 – 3	9	30.0
	4 – 6	6	20.0
	> 6	0	0.0
Spoilage problems of stored products	Yes	5	16.7
	No	25	83.3
Possible sources of spoilage	Moulds	3	10.0
	Insects/ rodents	2	6.7
Customers	Wholesalers, retailers and individual	8	26.7
	Wholesalers and retailers	3	10.0
	Retailers and individual	19	63.3
Do you receive any complaint from customers?	Yes	14	46.7
	No	16	53.3
What kind of complaint?	Inadequate dried products	2	6.7
	Easy breakage/brittle products	8	26.7
	Foreign matter contamination	3	10.0
	Discoloration of the products	1	3.3
Have customers return products?	Yes	6	20.0
	No	24	80.0
What you do for returned products?	Receive and destroy it	2	6.7
	Use/sell as animal/chicken feed	4	13.3

Key: <: less than; >: greater than; Source: (Author survey, 2023).

3.9. Processor's awareness on aflatoxin

The majority of respondents (90%) were unaware that mould growth in food could produce aflatoxins. Among the 10% who were aware, their knowledge primarily came from mass media and hospitals (Table 9). Only those who attended specialized training could identify diseases caused by aflatoxins, indicating that widespread unawareness may stem from insufficient education and training. Similarly, a study by Kimario *et al.* [26]

in Chamwino Dodoma, Tanzania, reported very low awareness of mycotoxins among smallholder farmers, with over half (53.3%) unaware of fungi. The current findings by Kitigwa *et al.* [27] found a low level of aflatoxin awareness (23.2%) among smallholder dairy farmers in three Tanzanian districts (Hai, Mpwapwa, and Serengeti). Massomo [33] also noted a general lack of awareness among Tanzanian smallholder farmers regarding aflatoxins' health and trade risks. This lack of awareness is corroborated by studies in other countries: 10% awareness in Rwanda [38], 21% in Uganda [37], and 25% in Tanzania [6]. In contrast, awareness in Kenya was relatively higher at 55% [54]. Among those who did recognize aflatoxin-related diseases, only 3.3% learned about them from colleagues, 3.3% from mass media, and another 3.3% from hospitals through doctors or nurses (Table 9). Also found that Tanzanian smallholder dairy farmers who had heard of aflatoxins mostly received information from radios/televisions (47.7%) and extension officers (16.9%) [27]. Ayo *et al.* [6] similarly reported that mass media, village officers, and extension officers are key information sources about aflatoxins for Tanzanian smallholder dairy farmers.

The limited exposure to mass media and healthcare sources underscores the need for more structured education and training programs. Previous research indicates that education is crucial in raising awareness and reducing aflatoxin contamination in foods [6,24].

Table 9. Processor's awareness on aflatoxin

Variable	Respondents/ categories	Frequency	Percent (%)
Do you know mould cause toxin in food?	Yes	3	10.0
	No	27	90.0
If yes, which toxin?	Aflatoxin	3	10.0
How did you know?	Mass media	1	3.3
	Hospital	1	3.3
	Colleague	1	3.3
Which condition can result to mould growth?	Inadequate drying	10	33.3
	Moisture up-take	5	16.7
	Inadequate cleaned storage room	2	6.7
	I don't know	13	43.3
Do you know that aflatoxin can affect human health?	Yes	3	10.0
	No	27	90.0
Which health effect?	Cancer	1	3.3
	Vomiting	1	3.3
	Nausea	1	3.3

Source: (Author survey, 2023).

Findings reveal that 90% of processors lacked awareness about aflatoxins and their health impacts (Table 9). A study in Kilosa, Tanzania, found that 66.7% of respondents were unaware of mycotoxin-related health hazards [32]. Similarly, different studies conducted by Matumba *et al.* [35] and Kimario *et al.* [26] reported significant gaps in knowledge about health effects from fungi contamination among smallholder farmers in Malawi and Tanzania (Chamwino Dodoma), respectively. Generally, the majorities of small-scale processors in developing countries, including Tanzania, are less aware of aflatoxin contamination and the associated health impacts that might arise after consuming aflatoxin-contaminated foods [51]. To address these knowledge gaps, structured education and training programs are essential for small-scale processors to enhance aflatoxin awareness and mitigate health risks.

4. Conclusions

The pasta processing industry in the country is largely dominated by micro- and small-scale companies with limited knowledge and training in product handling. The lack of proper training and awareness of regulatory standards poses significant risks to hygiene and safety. Issues such as poor hygienic practices, inadequate storage, and the reuse of contaminated packaging materials can undermine the quality of processed folded vermicelli. To address these concerns, targeted interventions and training programs are essential for improving safety standards. Investing in better facilities, equipment, and personnel training on best practices is crucial for ensuring product quality. Food control authorities must closely monitor the industry to maintain high safety and quality standards. Ensuring robust training and stringent oversight is critical to guarantee the safety and quality of folded vermicelli products.

Author Contributions: This study was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Funding: This research was funded by MINISTRY OF AGRICULTURE (MoA), and the APC was funded by ME.

Acknowledgments: The authors are highly grateful to the authority of the Ministry of Agriculture (MoA) for funding this research and Sokoine University of Agriculture (SUA) for their support in conducting this research. Authors also express sincere thanks to all people who assisted in the execution of this study, particularly the staff members of the Department of Food Science and Agro-processing, SUA.

Conflicts of Interest: The authors declare no conflicts of interest.

References

- [1] Acharya, A.S.; Prakash, A.; Saxena, P.; Nigam, A. Sampling: why and how of it? *Indian Journal of Medical Specialities* **2013**, *4*(2). <https://doi.org/10.7713/ijms.2013.0032>
- [2] Agarwal, S.; Singh, C.E.; Ekta, S.C.C. Extrusion processing: The effect on nutrients and based products. ~ 464 ~ *The Pharma Innovation Journal*, 2019, *8*(4), 464–470. <https://www.thepharmajournal.com>
- [3] Ali, A.H.; Kilima, B.M., and Wenaty, A. Assessment of Food Safety Knowledge, Hygienic Practices and Microbiological Quality of Halwa Produced in Urban West Region, Zanzibar. *European Journal of Nutrition & Food Safety* **2023**, *15*(12), 117–129. <https://doi.org/10.9734/EJNFS/2023/v15i121372>
- [4] Annor, G.A.; Baiden, E.A. Evaluation of Food Hygiene Knowledge Attitudes and Practices of Food Handlers in Food Businesses in Accra, Ghana. *Food and Nutrition Sciences* **2011**, *02*(08), 830–836. <https://doi.org/10.4236/fns.2011.28114>
- [5] Atanda, S.A.; Pessu, P.O.; Agoda, S.; Isong, I.U.; Ikotun, I. The concepts and problems of post-harvest food losses in perishable crops. *African Journal of Food Science* **2011**, *5*(11), 603–613. <http://www.academicjournals.org/AJFS>
- [6] Ayo, E.M.; Matem, A.; Laswai, G.H.; Kimanya, M.E. Socioeconomic Characteristics Influencing Level of Awareness of Aflatoxin Contamination of Feeds among Livestock Farmers in Meru District of Tanzania. *Scientifica*, 2018. <https://doi.org/10.1155/2018/3485967>
- [7] Azahar, H.; Ariff, A.; Hartini, Z. A visual analysis of packaging and labelling design of traditional snack foods in context of Malay SME in Malacca. December, 2004.
- [8] Bashir, K. Physio-Chemical and Sensory Characteristics of Pasta Fortified With Chickpea Flour and Defatted Soy Flour. *IOSR Journal of Environmental Science, Toxicology and Food Technology* **2012**, *1*(5), 34–39. <https://doi.org/10.9790/2402-0153439>
- [9] Batt, C.A. Food Safety Assurance. In *Reference Module in Food Science*. Elsevier, 2016. <https://doi.org/10.1016/b978-0-08-100596-5.03442-9>
- [10] Bresciani, A.; Pagani, M.A.; Marti, A. Pasta-Making Process: A Narrative Review on the Relation between Process Variables and Pasta Quality. *Foods*, 2022, *11*(3), 256. <https://doi.org/10.3390/foods11030256>
- [11] Chijoriga, Z. Quality and safety of peanut butter processed by small and medium enterprises in Dar Es Salaam Region, 2017, 123.
- [12] Claval, P.; Jourdain-Annequin, C. The Dynamics of Mediterranean Food Cultures in Periods of Globalization. *Athens Journal of Mediterranean Studies* **2017**, *4*(3), 225–242. <https://doi.org/10.30958/ajms.4-3-4>
- [13] Djukic, D.; Moracanin, S.V.; Milijasevic, M.; Babic, J.; Memisi, N.; Mandic, L. Food safety and food sanitation. *Journal of Hygienic Engineering and Design* **2016**, *14*, 25–31.

- [14] Dudeja, P.; Singh, A. Food safety from farm-to-fork-food-safety issues related to processing. In *Food Safety in the 21st Century: Public Health Perspective*. Elsevier Inc. 2017. <https://doi.org/10.1016/B978-0-12-801773-9.00015-7>
- [15] Ebert, M. Hygiene Principles to Avoid Contamination/Cross-Contamination in the Kitchen and During Food Processing. In *Staphylococcus Aureus*. Elsevier Inc. 2017. <https://doi.org/10.1016/B978-0-12-809671-0.00011-5>
- [16] FAO., and WHO. *General Principles of Food Hygiene. Codex Alimentarius Code of Practice, No.CXC 1-1969. Codex Alimentarius Commission*. 2023, 4–35.
- [17] Fritz, M.; Schiefer, G. Tracking, tracing, and business process interests in food commodities: A multi-level decision complexity. *International Journal of Production Economics*, 2009, 117(2), 317–329. <https://doi.org/10.1016/j.ijpe.2008.10.015>
- [18] Georgiadis, P.; Vlachos, D.; Iakovou, E. A system dynamics modeling framework for the strategic supply chain management of food chains. *Journal of Food Engineering* 2005, 70(3), 351–364. <https://doi.org/10.1016/j.jfoodeng.2004.06.030>
- [19] Giannetti, V.; Boccacci, M.M.; Marini, F.; Biancolillo, A. Effects of thermal treatments on durum wheat pasta flavour during production process: A modelling approach to provide added-value to pasta dried at low temperatures. *Talanta*, 2021, 225 (December 2020), 121955. <https://doi.org/10.1016/j.talanta.2020.121955>
- [20] Hassan, J.K.; Fweja, L.W.T. Food hygienic practices and safety measures among street food vendors in Zanzibar Urban District. *EFood*, 2020, 1(4), 332-338.
- [21] Holah, J.T. Cleaning and disinfection practices in food processing. In *Hygiene in Food Processing: Principles and Practice: Second Edition* (Vol. 259). Woodhead Publishing Limited, 2013. <https://doi.org/10.1533/9780857098634.3.259>
- [22] Hossain, M.S.; Santhanam, A.; Nik, N.N.A.; Omar, A.K.M. Clinical solid waste management practices and its impact on human health and environment - A review. *Waste Management*, 2011, 31(4), 754–766. <https://doi.org/10.1016/j.wasman.2010.11.008>
- [23] Ilhan, I.; Turan, D.; Gibson, I.; ten Klooster, R. Understanding the factors affecting the seal integrity in heat sealed flexible food packages: A review. *Packaging Technology and Science*, 2021, 34(6), 321–337. <https://doi.org/10.1002/pts.2564>
- [24] Jolly, C.M.; Bayard, B.; Awuah, R.T.; Fialor, S.C.; Williams, J.T. Examining the structure of awareness and perceptions of groundnut aflatoxin among Ghanaian health and agricultural professionals and its influence on their actions. *Journal of Socio-Economics* 2009, 38(2), 280–287. <https://doi.org/10.1016/j.socec.2008.05.013>
- [25] Kamboj, S.; Gupta, N.; Bandral, J.D.; Gandotra, G.; Anjum, N. Food safety and hygiene: A review. *International Journal of Chemical Studies* 2020, 8(2), 358–368. <https://doi.org/10.22271/chemi.2020.v8.i2f.8794>
- [26] Kimario, M.E.; Moshi, A.P.; Ndossi, H.P.; Kiwango, P.A.; Shirima, G.G.; Kussaga, J.B. *Smallholder farmers' storage practices and awareness on aflatoxin contamination of cereals and oilseeds in*. 2022, 13(June), 13–23. <https://doi.org/10.5897/JCO2020.0220>
- [27] Kitigwa, S.J.; Kimaro, E.G.; Nagagi, Y.P.; Kussaga, J.B.; Suleiman, R.A.; Matemu, A. *Occurrence and associated risk factors of aflatoxin contamination in animal feeds and raw milk from three agroecological zones of Tanzania*. 2023, 16(2), 149–163. <https://doi.org/10.3920/WMJ2022.2801>
- [28] Kothari, C.R.; Garg, G. *Research Methodology: Methods and Techniques*. New Age International (P) Limited, Publishers. 2004. 4835/24, Ansari Road, Daryaganj, New Delhi-110002. <https://www.newagepublishers.com>
- [29] Kussaga, B.; Luning, P.A.; Tiisekwa, B.P.M. *Challenges in Performance of Food Safety Management Systems: A Case of Fish Processing Companies in Tanzania*. 2014, 77(4), 621–630. <https://doi.org/10.4315/0362-028X.JFP-13-254>
- [30] Kussaga, J.B.; Luning, P.A. *Current performance of food safety management systems of dairy processing companies in Tanzania*. 2015, 68(2). <https://doi.org/10.1111/1471-0307.12183>
- [31] Loewe, M.; Al-Ayouty, I.; Altpeter, A.; Borbein, L.; Chantelauze, M.; Kern, M.; Niendorf, E.; Reda, M. Which Factors Determine the Upgrading of Small and Medium-Sized Enterprises (SMEs)? The Case of Egypt. In *SSRN Electronic Journal*, 2013. <https://doi.org/10.2139/ssrn.2283056>
- [32] Magembe, K.S.; Mwatawala, M.W.; Mamiro, D.P.; Chingonikaya, E.E. Assessment of awareness of mycotoxins infections in stored maize (*Zea mays L.*) and groundnut (*Arachis hypogea l.*) in Kilosa district, Tanzania. *International Journal of Food Contamination*, 2016, 3(1). <https://doi.org/10.1186/s40550-016-0035-5>
- [33] Massomo, S.M.S. *Aspergillus flavus* and aflatoxin contamination in the maize value chain and what needs to be done in Tanzania. *Scientific African* 2020, 10, e00606. <https://doi.org/10.1016/j.sciaf.2020.e00606>
- [34] Masunzu, N. Safety and quality of commercial cereal-based complementary foods produced and marketed in Mwanza region, 2017.
- [35] Matumba, L.; Van Poucke, C.; Njumbe, E.E.; Jacobs, B.; De Saeger, S. Effectiveness of hand sorting, flotation/washing, dehulling and combinations thereof on the decontamination of mycotoxin-contaminated white maize. *Food Additives and Contaminants - Part A Chemistry, Analysis, Control, Exposure and Risk Assessment*, 2015, 32(6), 960–969. <https://doi.org/10.1080/19440049.2015.1029535>
- [36] Messer, K.D.; Costanigro, M.; Kaiser, H.M. Labeling food processes: The good, the bad and the ugly. *Applied Economic Perspectives and Policy* 2017, 39(3), 407–427. <https://doi.org/10.1093/aep/pxp028>
- [37] Nakavuma, J.L.; Kirabo, A.; Bogere, P.; Nabulime, M.M.; Kaaya, A.N.; Gnonlonfin, B. Awareness of mycotoxins and occurrence of aflatoxins in poultry feeds and feed ingredients in selected regions of Uganda. *International Journal of Food Contamination* 2020, 7(1), 1–10. <https://doi.org/10.1186/s40550-020-00079-2>
- [38] Nishimwe, K.; Bowers, E.; Ayabagabo, J.D.; Habimana, R.; Mutiga, S.; Maier, D. Assessment of aflatoxin and fumonisin contamination and associated risk factors in feed and feed ingredients in Rwanda. *Toxins* 2019, 11(5), 1–15. <https://doi.org/10.3390/toxins11050270>

- [39] Okpala, C.O.R.; Korzeniowska, M. Understanding the Relevance of Quality Management in Agro-food Product Industry: From Ethical Considerations to Assuring Food Hygiene Quality Safety Standards and Its Associated Processes. *Food Reviews International*, 2023, 39(4), 1879–1952. <https://doi.org/10.1080/87559129.2021.1938600>
- [40] Osei, T.B.; Anfu, P.O. Evaluation of the food safety and quality management systems of the cottage food manufacturing industry in Ghana. *Food Control* **2019**, 101 (February), 24–28. <https://doi.org/10.1016/j.foodcont.2019.02.028>
- [41] Pleadin, J.; Staver, M.M.; Markov, K.; Frece, J.; Zadravec, M.; Jaki, V.; Krupić, I.; Vahčić, N. Mycotoxins in Organic and Conventional Cereals and Cereal Products Grown and Marketed in Croatia. *Mycotoxin Res.* **2017**, (3), 219–227. DOI: 10.1007/s12550-017-0280-3.
- [42] Quinn, M.M.; Henneberger, P.K.; Braun, B.; Delclos, G.L.; Fagan, K.; Huang, V.; Knaack, J.L.S.; Kusek, L.; Lee, S.J.; Le, M.N.; Maher, K.A.E.; McCrone, S.H.; Mitchell, A.H.; Pechter, E.; Rosenman, K.; Schulster, L.; Stephens, A.C.; Wilburn, S.; Zock, J.P. Cleaning and disinfecting environmental surfaces in health care: Toward an integrated framework for infection and occupational illness prevention. *American Journal of Infection Control* **2015**, 43(5), 424–434. <https://doi.org/10.1016/j.ajic.2015.01.029>
- [43] Rabia, A.R.; Kimera, S.L.; Wambura, P.N.; Mdegela, R.H.; Misinzo, G.; Mbazi, E.; Ngaya, R.; Mzula, A. Knowledge, attitude and practices on handling, processing and consumption of marine foods in Zanzibar, Tanzania. 2017.
- [44] Ruteri, J.M. Supply Chain Management and Challenges Facing the Food Industry Sector in Tanzania. *International Journal of Business and Management* **2009**, 4(12). <https://doi.org/10.5539/ijbm.v4n12p70>
- [45] Sacco, C.; Donato, R.; Zanella, B.; Pini, G.; Pettini, L.; Marino, M.F.; Rookmin, A.D.; Marvasi, M. Mycotoxins and Flours: Effect of Type of Crop, Organic Production, Packaging Type on the Recovery of Fungal Genus and Mycotoxins. *Int. J. Food Microbiology* **2020**, 334, 108808. DOI: 10.1016/j.ijfoodmicro.2020.108808.
- [46] Sasongko, S.B.; Rini, B.P.; Maehiroh, H.; Utari, F.D.; Djaeni, M. The Effect of Temperature on Vermicelli Drying under Dehumidified Air. *IOP Conference Series: Materials Science and Engineering* **2021**, 1053(1), 012102. <https://doi.org/10.1088/1757-899x/1053/1/012102>
- [47] Schabo, D.C.; Martins, L.M.; Maciel, J.F.; Iamanaka, B.T.; Taniwaki, M.H.; Schaffner, D.W.; Magnani, M. Production of Aflatoxin B₁ and B₂ by *Aspergillus flavus* in Inoculated Wheat Using Typical Craft Beer Malting Conditions. *Food Microbiology* **2020**, 89, 103456. DOI: 10.1016/j.fm.2020.103456.
- [48] Sousa, C.P.D. BRAZILIAN ARCHIVES OF BIOLOGY AND TECHNOLOGY The Impact of Food Manufacturing Practices on Food borne Diseases. *Braz. Arch. Biol. Technol.* **2008**, 51, 815–823.
- [49] Todd, E.C.D.; Michaels, B.S.; Greig, J.D.; Smith, D.; Bartleson, C.A. Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 8. Gloves as barriers to prevent contamination of food by workers. *Journal of Food Protection* **2010**, 73(9), 1762–1773. <https://doi.org/10.4315/0362-028X-73.9.1762>
- [50] Tolmacheva, T.; Toshev, A.; Androsova, N. *Methods for ensuring the quality and safety of raw materials used in food for athletes*. 17(Icistis), 2019, 270–274. <https://doi.org/10.2991/icistis-19.2019.69>
- [51] Unnevehr, L.; Grace, D. The role of risk assessment in guiding aflatoxin policy. *Aflatoxins: Finding Solutions for Improved Food Safety*, 2013, 14. <https://www.ifpri.org>
- [52] Varzakas, T. Quality and safety aspects of cereals (Wheat) and their products. *Critical Reviews in Food Science and Nutrition* **2016**, 56(15), 2495–2510. <https://doi.org/10.1080/10408398.2013.866070>
- [53] Vasconcellos, J.A. Quality assurance for the food industry: A practical approach. *Quality Assurance for the Food Industry: A Practical Approach*, 2003, 1–422.
- [54] Walke, M.; Mtimet, N.; Baker, D.; Lindahl, J.; Hartmann, M.; Grace, D. Kenyan perceptions of aflatoxin: An analysis of raw milk consumption. *Paper Prepared for Presentation at the EAAE 2014 Congress 'Agri-Food and Rural Innovations for Healthier Societies,' August 26 to 29, 2014, Ljubljana, Slovenia.* <http://purl.umn.edu/182729%5Cnhttp://ebrary.ifpri.org/cdm/ref/collection/p15738coll9/id/42>
- [55] Zambrano, M.V.; Dutta, B.; Mercer, D.G.; MacLean, H.L.; Touchie, M.F. Assessment of moisture content measurement methods of dried food products in small-scale operations in developing countries: A review. *Trends in Food Science and Technology* **2019**, 88, 484–496.
- [56] Zhao, Y.; Wang, Q.; Huang, J.; Ma, L.; Chen, Z.; Wang, F. Aflatoxin B₁ and Sterigmatocystin in Wheat and Wheat Products from Supermarkets in China. *Food Addit. Contam. B.* **2018**, 11(1), 9–14. DOI: 10.1080/19393210.2017.1388295