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Editorial

Role of Participatory Guarantee System (PGS) in organic small scale farmers for ensuring Food Safety

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The current condition of food safety

Approximately 10% of the global population is living in extreme poverty (FAO, 2018). Eighty per cent of the extremely poor have a living wage equal to <USD 1.90/day, and almost 80% of the moderately poor live in rural areas (Castañeda et al., 2016). In 2018, There was a high correlation between extreme poverty and the 821 million people still suffering from hunger (FAO and IFAD, 2019).

In developing countries, the estimation of contamination of mycotoxin is more than 25% of the world food supply, and nearly 4.5 million people are exposed to these foods (Smith et al., 2015). Eskola et al. (2019) observed that 60-80% of food carry detectable levels of mycotoxin. Food safety hazards and foodborne diseases potentially emanate and accumulate from sources of contamination along the pathway from production to consumption (Breman et al., 2007). Consequently, the production of food and food contamination along the pathway becomes a double burden for security.

Small scale farmers

In developing countries, most farmers are small-scale farmers with less than 2.0 hectares (HLPE 2013, IFAD 2016). In this condition, small scale farmers suffer from a lack of how-to-knowledge to increase yields (economically) as well as improve their yield quality (food safety). As the case mentioned above, small-scale farmers need a particular system to ensure their food has been harvested and processed correctly. The system should be aimed to reduce contamination as well as to increase food safety from the beginning (farmers).

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Food-safety refers to routines in the preparation, handling and storage of food meant to prevent food-borne illness and injury. From farm to fork, food products may encounter any number of health hazards during their journey through the supply chain. The implementation of safe food handling practices and procedures are present in every stage of food production, processing and consumption. The food system is aiming to curb these risks and prevent harm to consumers.

In organic small-scale farming, a guarantee system has been implemented independently through a participatory system, or what is known as a participatory guarantee system (PGS). The system has a focus on the quality assurance of organically produced foods based on a foundation of trust, social networks and knowledge exchange (IFOAM, 2008). According to IFOAM – Organics International "PGS is a low-cost, locally-based system of quality assurance with a strong emphasis on social control and knowledge building". Through the participation of stakeholders and a trust system, food safety procedures should be easy to establish along the supply chain from the farmer to the processor. As a note, many non-processing foods or horticulture products need this system as well. The role of every individual in maintaining food safety is essential, starting with the farmer and ending with the consumer. For farmers, there are many responsibilities, including making sure the food they produce is safe for customers. For instance, procedures to keep equipment and harvesting tools clean may reduce the risk of contamination. The procedure can be incorporated and implemented through the PGS system, where it is low cost as well as effective in the small-scale farm.

Participation, voluntary involvement and awareness

If conventional farmers can learn from organic farmers on the PGS, they could also begin to share those values. For PGS to be effective, first, the power of participation must be strong. That includes the group of farmers and all stakeholders involved in the production, including consumers. Second, voluntarily involvement requires that everybody can take pride in the movement and in ensuring their production quality. Third, through this system, awareness of all stakeholders along the chain must be established gradually with an increase of shared information, and the direct benefits from the system must be observed.

Today's situation, with a global pandemic, awareness of food safety and concerns is increasing from the farm to the consumers. This momentum can be used as an "open door" for small scale conventional farmers to use PGS as a tool for increasing food safety during the production and harvesting stages. Food safety is a global responsibility; if we depended on small-scale organic farmers alone, it would not be enough to ensure the food safety of more than 25% of food supply contamination worldwide.

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Optimisation of cassava dried noodle using hydrocolloid and protein isolates: a tropical noodle

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Keywords

cooking loss, hardness, response surface method, tensile strength

Cassava flour has the potential to be used as a substitute for wheat flour to make dry noodles. This study aims to obtain the optimum cassava noodle formulation developed with cassava flour, hydrocolloid content, and protein isolate. The ingredients evaluated for cassava noodle formulation were native and pre-gelatinised flour, food additives such as hydrocolloid (xanthan gum and konjac glucomannan), and pea protein isolate. The design of the formulation and optimisation was done by the D-optimal combined design method and response surface method by using Design Expert 7.0® software. There were 31 different formulas for a test response: hardness, tensile strength, and cooking loss. Based on the test response, the recommended optimum noodles formulation was composed of pre-gelatinised cassava flour, 2% xanthan gum, and 4% protein isolate. The selected formula of cassava dried noodles constituted 5.92% water, 87.03% carbohydrate, 4.29 protein, 1.34% fat, and 0.79% ash. The level of consumer acceptance of texture, aroma, colour, and overall parameters ranged from 3 (regular) to 4 (like). The optimum formula may be used for the development of cassava dried noodles.

1. Introduction

Cassava (Manihot esculenta) is one type of tuber native to Indonesia. As the third staple food, following rice and corn (Murniati et al., 2020), the cassava productivity in various regions in Indonesia (2012 to 2016) increased by 2.85%, and production reached 22.819,484 tons (Nuryati et al., 2016). This fact proves that Indonesia is the largest cassava producer in Asia, with a production rate of 44 kg per capita per year, or more than 37.3 kg of the regional average (Howeler et al., 2013). Cassava is considered inferior because its presentation as a ready-to-eat food is less attractive, and it is a perishable food (Hariyadi, 2011). Cassava flour has the potential to be used as a substitute for flour to make dry noodles. It has similar characteristics to wheat flour, although it has a lower protein content (Maforimbo et al., 2008). Noodles contain protein, carbohydrates, minerals, and low fat. The nutrients of 100 g fine dried noodles are 10.3 g protein, 75.6 g carbohydrates, just 0.6 g fat, 129 mg potassium, 18.45 mg sodium, and 11.8 µg selenium (Zhang & Ma, 2016). The application of cassava flour in pasta products has advantages, namely gluten-free protein (gluten-free) that can benefit consumers with celiac disease (Fasano & Catassi, 2012).

In Indonesia, instant noodle demand amounted to 12,520 million USD in 2019 (World Instant Noodles Association, 2020). Despite claims it has the sec-

ond-highest country in instant noodle consumption (Gulia et al., 2014), Indonesia must import wheat flour from abroad. That is because wheat only grows well in a four-seasoned and sub-tropical region, unlike Indonesia (Pato et al., 2016). The utilisation of cassava flour for noodles can reduce wheat flour consumption in Indonesia (Novelina et al., 2014; Tan et al., 2009). Cassava flour is produced from dried cassava by grinding (Niba et al., 2006). Its starch can be used as an emulsifier and thickener (Gaouar et al., 1997). Cassava flour used in the manufacture of noodles requires the addition of other ingredients such as hydrocolloid, protein isolates, and enzymes as a binder for forming a dough structure so that it is cohesive enough to resemble flour (Purnomo et al., 2015; Padalino et al., 2016).

One of the most commonly used hydrocolloids is xanthan gum. Xanthan gum is a polysaccharide secreted by Xanthomonas campestris and is generally used as a thickener in various food products (Kaur et al., 2015). In addition to xanthan gum, other hydrocolloids such as konjac glucomannan flour can improve paste characteristics by increasing the hardness of noodles, elongation, tensile strength, and cohesiveness (Husniati & Devi, 2013). Xanthan gum and konjac glucomannan can be used simultaneously, the interaction can produce gelation viscosity better than its single-use (BeMiller, 2008). Cassava has a low protein content, plus the siege process causes protein levels in the ingredients to decrease. Protein addition can improve the characteristics and nutrition of gluten-free food products through the interaction of starch with protein (Detchewa et al., 2016). Therefore, it is essential to know the effect of hydrocolloid use in combination with protein isolates to native cassava-based gluten-free noodles and pregelatinised-modified noodles to find out the quality of the final product.

2. Materials and Methods

2.1. Materials

Cassava flour, both native and pre-gelatinised, were produced from Manihot esculenta var. Manggu was provided by Balitbang Pascapanen, Bogor, Indonesia. Xanthan gum commercially obtained from Balitbang Pascapanen. Konjac glucomannan flour was obtained from Amorphillus sp., and isolated pea protein was obtained from PT Lissom Indonesia.

2.2. Methods

Pasting properties of cassava flour

The starch gelatinisation profile was analysed using Rapid Visco Analyzer (RVA). This analysis shows the viscosity properties of starch by measuring the resistance of flour and water mixture during stirring. A sample of 3 grams of flour was mixed with 25 ml of water to form the mixture. The sample of the mixture was stirred for 6 minutes on RVA with a heating temperature of 60-95**°C.** When heated, starch granules experience swelling, and the mixture thickens. From this analysis, temperature, time, and peak viscosity of the flour were determined (Wheat Marketing Center, 2004).

Production of cassava noodle

The fixed and optimised ingredient amounts are shown in Table 1. Cassava noodle was produced using two types of flour, native and pre-gelatinised. Pea protein isolates and hydrocolloid (xanthan gum and konjac) are variables that can affect the textural quality of noodles. Response Surface Method (RSM) was used to optimise the formulation of cassava noodles. D-optimal Combined Design was generated through the software of Design Expert 7.0 ®.

Table 1. The proportions of ingredients included in the formulation of cassava noodle

Ingredients	Unit	Amount
Cassava flour (native or pregelatinized)	gram	200
Pea protein isolates	%	6
Water	mL	50
Hydrocolloid (xanthan gum or konjac glucomannan)	%	2

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Noodles were made using an automatic noodle maker, Re-noodle (type RN-88 Premium from RBShop). Before forming noodles, the flour mixture was first stirred in the appliance for about 1 minute. The noodles were then dried in an oven with a temperature of 60**°C** for 5 hours. The process of making noodles began with mixing the main ingredients (flour) with the other ingredients (xanthan gum, konjac glucomannan, and protein isolates). The concentration of additional ingredients varied according to the experimental design (Table 2). Next, the dry ingredients were mixed with 25% water, or as much as 50 ml in one recipe. The dough was steamed over boiling water for 7 minutes. Noodles were formed using Re-noodle with standard dye.

Characteristics of cassava noodle

Texture: Hardness and tensile strength

The texture profile of the noodles was evaluated using the CT3 Brookfield texture analyser. The string of noodles was cooked in 300 mL of water for 9 to 10 minutes, removed and then drained. The analysis was carried out using a cylinder probe (TA-AACC36). Samples were compressed twice to 25% of the original sample height. Three replicate samples were tested. Tensile strength analysis was conducted using a single strand of noodles (± 5 cm) that had been rehydrated, was wrapped around a Dual-Grip Fixture (TA-DGF) probe with a probe distance of 2 cm and a velocity of 0.3 cm/sec.

Cooking loss

Cooking loss was determined by Kim et al. (2014) methods. Approximately 3 g of dried noodle samples were cut to 5 cm and weighed. Dry noodle samples were cooked in 100 ml of boiling water for 10 minutes. Cooking time was determined based on the time needed to remove the white centre core when pressed between two Petri dishes. Checking was done every minute, from the 3rd minute to the 10th minute. Boiled water from the cooking was collected in a beaker glass and cooled for 3 minutes at room temperature. Cooking loss was calculated as the number of solids lost in the water during cooking, expressed as the ratio of the weight of the residual in cooking water to the sample weight on a dry basis. The weight of the residual cooking water was obtained by drying the beaker in an oven at 98**°C** for 24 hours. The cooking loss was expressed as the ratio of residue weight in the cooking water to the weight of the noodle on a dry weight basis.

Proximate analysis

Proximate analysis was conducted by using AOAC (2005) method, with type number of 32.5.02, 32.5.03, 32.5.05, 32.5.07 for water, ash, fat, and protein (conversion factor of 6.25) respectively. Carbohydrate content was analysed using the differences method.

Sensory analysis

Samples (100 g) were cut into approximately 15 cm of length and cooked according to optimal time (the time when the white core in the cross-section disappeared). The cooked noodle was drained for a maximum of 10 minutes before analysis. Sensory analysis was carried out using a hedonic rating test with 30 untrained panellists. Parameters observed were a taste, colour, texture, and overall with a range of assessment scores from numbers 1 (dislike) to 5 (like).

3. Results and Discussion

3.1. Cassava flour characteristics

The maximum viscosity is the highest viscosity achieved before the starch granules break due to the inability of holding water. The high viscosity of native flour shows high water binding ability and high swelling process. In pre-gelatinised flour, starch granules have been damaged so they can quickly gelatinise. As a result, when flour is given by pre-gelatinised treatment, a continuous increase in heat will reduce the viscosity of the paste (Wadchararat et al., 2006). Based on Ahmed et al. (2012), pre-gelatinised flour, which is processed by extrusion, reduces viscosity and decreases the ability of cold-water-swelling because of the degradation of amylose and amylopectin due to high-temperature treatment and shear stress. Once at a maximum point, the viscosity of the starch decreases suddenly as the temperature increases (Mojiono et al., 2016). The breakdown viscosity shows the level of stability of the starch to heating. The lower the breakdown viscosity value, the more stable the starch paste is to heating. Starch granules that have been swelled are easily destroyed by heating and stirring (Pomer-

anz, 1991). Setback viscosity shows the value of the paste viscosity after cooling, and can also be used in determining the retrogradation and syneresis properties of starch. Native cassava flour had a setback viscosity value of -2783 cP, while pre-gelatinised cassava flour was 852 cP. The high setback viscosity value indicates that the starch was more accessible to retrograde compared to pre-gelatinised flour.

Table 2. Experimentl design for cassava noodle with the actual level of variable evaluated (flour hydrocolloid and protein isolates)

Formula	Variable			
	Flour	XG (%)	KG (%)	PPI (%)
F1	A	0.00	2.00	4.43
F2	A	0.00	2.00	4.61
F3	A	0.00	2.00	6.00
F4	A	0.33	1.67	5.36
F5	A	0.55	1.45	6.00
F6	A	0.58	1.42	4.00
F7	A	0.72	1.28	4.00
F8	A	0.81	1.20	4.69
F9	A	0.98	1.02	4.47
F10	A	1.04	0.96	4.55
F11	A	1.13	0.87	5.25
F12 (1)	A	1.45	0.55	6.00
F12 (2)	A	1.45	0.55	6.00
F13	A	1.50	0.50	4.00
F14	A	2.00	0.00	4.42
F15	A	2.00	0.00	5.37
F16 (1)	A	2.00	0.00	6.00
F16 (2)	A	2.00	0.00	6.00
F17 (1)	B	0.00	2.00	4.00
F17 (2)	B	0.00	2.00	4.00
F17 (3)	B	0.00	2.00	4.00
F18	B	0.00	2.00	4.79
F19	B	0.00	2.00	6.00
F20	B	0.46	1.54	5.36
F21	B	0.56	1.44	4.43
F22	B	0.81	1.20	4.11
F23	B	0.82	1.12	6.00
F24	B	0.96	1.04	5.28
F25	B	1.14	0.86	4.86
F26	B	1.17	0.83	4.20
F27	B	1.38	0.64	5.60
F28	B	1.48	0.52	4.19
F29	B	2.000	0.00	4.42
F30	B	2.000	0.00	4.64
F31 (1)	B	2.000	0.00	6.00
F31 (2)	B	2.000	0.00	6.00

A: Pre-gelatinized flour; B: Native flour; XG: Xanthan gum, KG: Konjac glucomannan, PPI: Pea protein isolates

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Table 3. Gelatinization profile of cassava flour using rapid visco analyzer (RVA)

Parameter	Unit	Native Cassava Flour	Pregelatinized Cassava Flour
Temperature at 20 cP	°C	75.8	73.6
Time at 20 cP	s	374	187
Peak viscocity	cP	5956	3954
Temperature at peak viscosity	°C	84.3	92.2
Time at peak viscosity	s	452	230
Cold paste viscocity	cP	3174	4806
Breakdown	cP	3409	1414
Setback	cP	-2783	852

3.2. Characteristics of cassava noodle

Hardness

Hardness is a quantitative calculation of the amount of load (grams) needed to break the sample (Sundarajan & Roy, 2001). The harder sample will increase the weight of the load. Figure 1 shows that the use of 2% xanthan gum and 0% konjac glucomannan, accompanied by the smallest percentage of protein isolates, produced the maximum hardness value of native flour-based noodles. The maximum hardness in pre-gelatinised cassava-based noodles also leads to 2% xanthan gum, 0% konjac glucomannan, and 4% protein isolates. The addition of hydrocolloid is reported to improve the quality of hardness in pasta (Rossel et al., 2001). The hardness response of the noodles reached the maximum value when the addition of xanthan gum increased. This can be caused by the formation of complexes due to the interaction of hydrophilic groups on starch, xanthan gum, fat, and protein. Xanthan gum has a double helix structure between hydrogen bonds, and the structure of secondary polymers can increase water holding capacity and stability of noodle texture (Pan et al., 2016). Hardness is influenced by high levels of amylose in starch (Guo et al., 2003). Pregelatinized flour has a higher amylose content than native flour due to the partial gelatinisation treatment, which causes amylose to come out of starch granules. Through the gelatinisation profile, cassava flour pre-gelatinisation also showed a more dominant amylose character compared to the properties of amylopectin (Kaur et al., 2016).

Tensile strength

Figure 2 shows that the addition of hydrocolloid concentration, both xanthan gum and glucomannan, increased the response value for the lowest level of protein isolate used. As the protein isolate level increases, the plot graph shows a blue colour, which means a lowering in the tensile strength of the noodles. In contrast, noodles with pre-gelatinised cassava flour show most of the yellow to orange-green, meaning the use of pre-gelatinised flour increases tensile strength. The maximum response value was obtained when the concentration of xanthan gum: konjac glucomannan is 0:2%, plus 4% protein isolates. The factor that influences the tensile strength of noodles is the amylose content in cassava flour, which ranged from 15 to 25% (Eliasson, 2004). Based on Eliasson and Gudmundsson (1996), the high dissolved amylose and the swelling of a starch granule during gelatinisation will increase the elasticity of noodles, while the high amylopectin dissolved in water will interfere with gelation formation.

Cooking loss

Good quality noodles have a low-value cooking loss because high cooking loss indicates the weak bond between the components marked by the loss of starch and other solid components (Kim et al., 2014). Hydrocolloid functions as a binding material to maintain the structure of the noodles, so that the noodles did not easily decompose during cooking. The use of pre-gelatinised cassava flour in making noodles significantly decreased the amount of cooking loss. The lowest value of cooking loss in pre-gelatinised cassava flour-based noodles was obtained when added 2% xanthan

gum, 0% konjac glucomannan, and 5.37% protein isolates. The lower cooking losses can be caused by the high amount of amylose in pre-gelatinised cassava flour. The addition of xanthan gum and konjac glucomannan can significantly affect the cooking.

3.3. Formulation optimisation

Formula optimisation was determined after the interpretation of response surfaces. The determination of the optimum formula was based on the highest desirability value. Desirability is based on the transformation of all the obtained responses from different scales into a scale-free value. Desirability shows the value of the optimisation objective function, which shows the ability of the program to fulfil the desires based on the criteria set in the final product, to obtain a satisfactory compromise (Jeong & Kim, 009). The criteria were determined based on responses to hardness, tensile strength, and cooking loss. A good quality noodle has a high level of hardness and tensile strength, so the criteria target for both responses is maximum. Noodle with a compact and homogeneous structure shows good cooking quality, so the response to cooking loss is minimum. Based on the desirability for the responses, the recommended formulation of the noodle was cassava flour pre-gelatinised based (100%), 2% xanthan gum, and 4% protein isolates. Noodles with this formula have a desirability value of 0.840. The formula had been verified by preparing noodles with the optimum ingredient of 200 g pre-gelatinised flour, 2% of xanthan gum, and 4% of protein isolate. The noodle had a hardness of 130.6 g, a tensile strength of 13.2 g, and cooking loss of 7.7%. The noodles quality in terms of cooking loss was found to be lower than those of noodle prepared from modified cassava flour (14.3%), as reported by Affifah and Ratnawati (2017). Low cooking loss is essential for noodles.

3.4. Proximate and sensory evaluation

The content of water, ash, protein, fat, and carbohydrate of the selected formulation was 5.92%; 0.79%; 4.29%; 1.34%; and 87.02%, respectively. The level of consumer acceptance for texture, aroma, colour, and overall parameters had a range of 3 (regular) to 4 (like).

4. Conclusion

Based on the research, it can be recommended that the optimum formulation for a noodle is pre-gelatinised cassava flour with the addition of 2% xanthan gum, 0% konjac glucomannan, and 4% pea protein isolates with a hardness value 130.6 g, tensile strength 13.2 g, and cooking loss of 7.7%. The content of water, ash, protein, fat, and carbohydrate of the selected for-

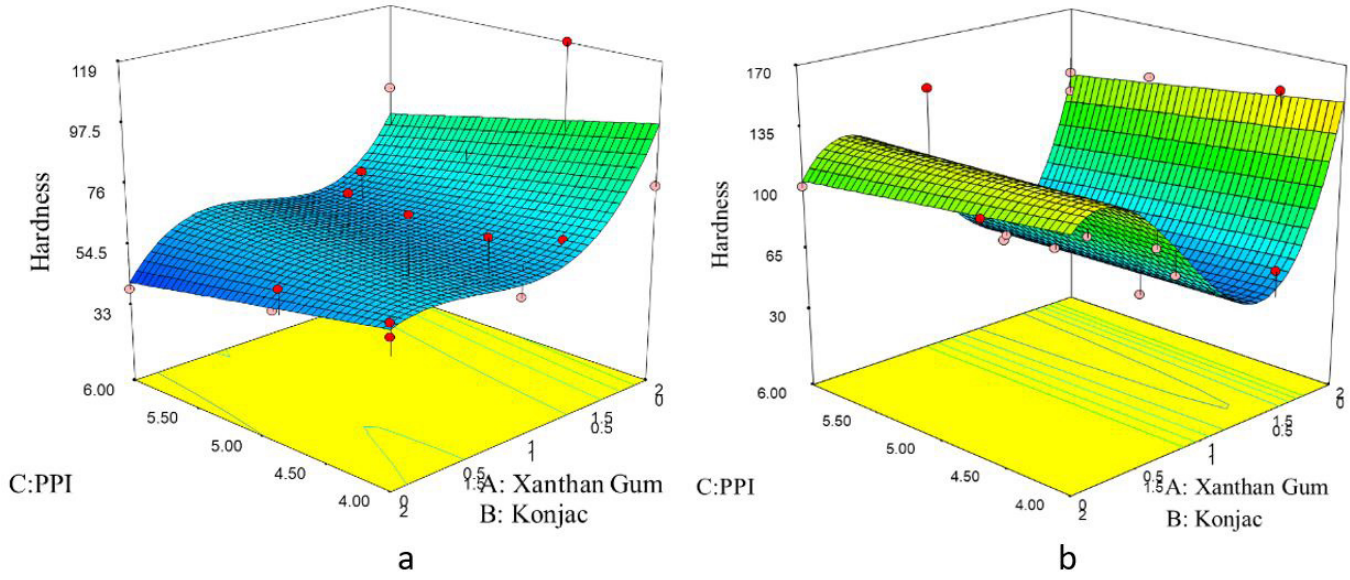

Figure 1. Effects of the component level hardness of native flour-based noodle (a) and pre-gelatinised flour-based noodle (b)

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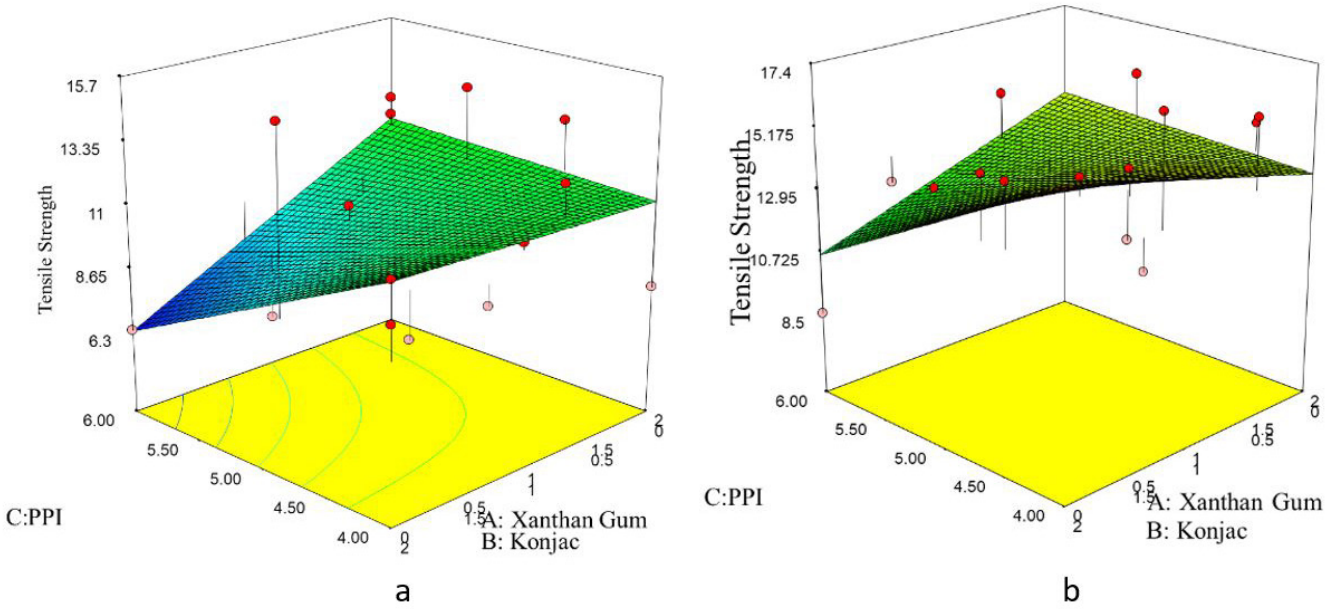

Figure 2. Effects of the component level tensile strength of native flour-based noodle (a) and pre-gelatinised flour-based noodle (b)

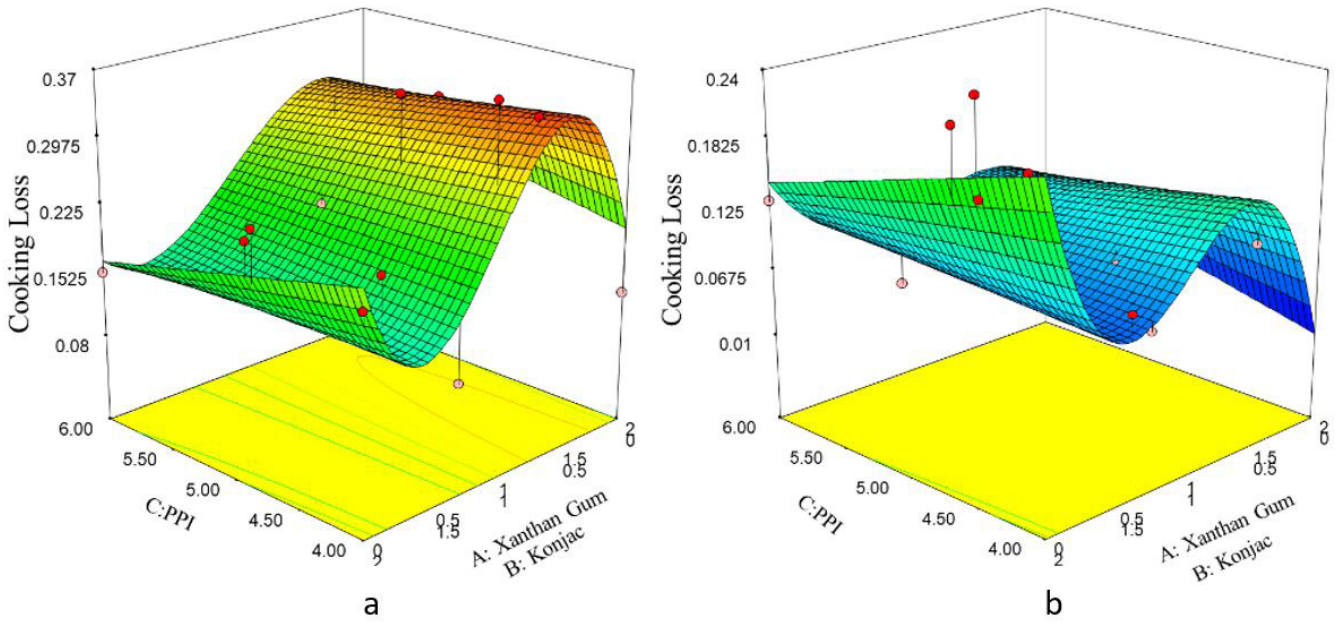

Figure 3. Effects of the component level cooking loss of native flour-based noodle (a) and pre-gelatinised flour-based noodle (b)

mulation was 5.92%, 0.79%, 4.29%, 1,34%, and 87.0%, respectively. For the sensory evaluation, the parameters tested were texture, aroma, colour, and overall. A total of 30 panellists participated. On average, panellists selected a level of preference with a range of 3 (regular) to 4 (likes).

Conflicts of interest

All the authors declared that they have no conflict of interest.

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Consumer's acceptability of rice-like grains made from cassava (Manihot esculenta Crantz) and corn (Zea mays)

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Rice is one of the most important crops in Asia. Several crops were explored as rice alternatives to reduce the burden of importation and improve food security. The purpose of this study was to develop a consumer acceptable rice-like grain from cassava and corn. Four (4) cassava varieties were combined with five (5) corn varieties at eleven (11) ratio levels, making a total of 220 combinations. The most acceptable ratios for each cassava-corn combination (n=19) were then subjected to consumer acceptability testing. Results showed that the five most acceptable combinations are Lakan 2-IPB Var 8, Binulak-IPB Var 8, Binulak-IPB Var 6, Lakan 2-IPB Var 13, and Rajah 4-IPB Var 6. Eighty-two per cent (82 %) of the respondents (n=120) preferred Lakan 2-IPB Var 13. These were also perceived as the most comparable and acceptable to rice ($r=0.753$; $p<0.01$). The study revealed that production of rice-like grains from other staples could potentially be an alternative to rice. Further studies may be done to improve the process, thus making the product more similar to rice.

1. Introduction

Rice is considered a staple food in the Philippines. The country's rapid population growth increased rice demand and the need to import rice over the past decade (Tibao, 2009). A study done by Francisco and his associates (2013) revealed that there is an increasing trend in the per capita rice consumption in the Philippines. Rice supplies up to 50% of the dietary caloric intake in populations living in poverty, making rice a critical factor for food security (Muthayya et al., 2014). There are several strategies done to ensure food security in Asia, such as macro policy reforms, agricultural and rural development policies, and interventions to improve poverty (FAO, 1999). However, there seems to be some disconnect in these strategies, and rice policy was the most distinct. While high prices for rice farmers are carried out to help reduce poverty, these high prices affect poor consumers the most (Timmer, 2013). This, in turn, sets a demand for cheaper alternatives to rice (Pandey et al., 2010). Other carbohydrate-rich crops, however, cannot compete with rice because of its distinct grain quality, colour, and aroma (Custodio et al., 2019).

Child undernutrition is a prevailing public health concern in developing countries. Children belonging to food-insecure households were more likely to

be stunted and underweight (Ali et al., 2013). It was found that one in three 2-year old children are irreversibly stunted, whereas there is a 30% stunting prevalence rate among 3 to 4-year old children (UNICEF, 2019). Barangay Dayap, Calauan ranks second to the twenty (20) most vulnerable barangays (district)in the province of Laguna, Philippines, based on hazard exposure such as the occurrence of typhoons and flooding events; and human, infrastructure, and livelihood sensitivity based on poverty rates, malnutrition, and involvement in agriculture. Barangay Dayap belongs to the lowland topographical classification, has one of the highest malnutrition rates, and has a low adaptive capacity based on technological, social, and human indicators (Mendoza et al., 2014). Furthermore, households in rural areas are heavy consumers of traditional staples, unlike urban households who tend to rely on fast food diets (Catelo, 2004).

Fervent measures must be done to improve the nutritional status of children, and one strategy is to improve the nutritional quality of staples. Efforts to increase the nutritive value of rice are made by developing rice analogues through extrusion—processing rice and fortifying it with minerals such as zinc and iron, others with vitamin A (Mishra et al., 2012). Peñaflor and his colleagues (2014), developed rice-like grains from broken rice and adlai (Job's tears) to utilise the broken rice and increase the nutritional value by adding the adlai. Cassava has much potential as a staple because not only does it contain high levels of carbohydrates, it also has calcium, iron, potassium, magnesium, zinc, copper and manganese. Beta-carotene was also observed in yellow-fleshed cassava, such as that of Lakan 1 variety (Montagnac et al., 2009; UPLB, 2018). White fleshed cassava varieties include Lakan 2 and Rajah 4 (UPLB, 2018; Mamaril et al., 2007).

On the other hand, corn is a vital source of starch and even non-starch polysaccharides. It also contains proteins and fat. The role of corn in human nutrition is also gaining much attention (Yongfeng & Jay-lin, 2016). Quality protein maize (QPM) is a corn variety that is high in both lysine and tryptophan; two of the essential amino acids (Ahenkora et al., 1999). IPB Var 6 is a white quality protein maize developed by the Institute of Plant Breeding (IPB), University of the Philippines Los Baños (UPLB, 2018). Other varieties developed by IPB are IPB Var 8 (white corn), IPB Var 11 (yellow) and Var 13 (yellow). Also, Camotes (CGUARD N68), a pigmented corn variety native of the Philippines, was found to increase the levels of antioxidant activity, as well as dietary fibre and zinc in crackers (Sales et al., 2018). These properties indicate that both cassava and corn are good candidates as alternative staples, all the more if they are combined as one product. The goal of this study was to develop rice-like grains from composites of cassava and corn. Moreover, it aimed to determine the consumer acceptability of these rice-like grains. Sensory evaluation was the basis for choosing combinations for consumer acceptability.

2. Materials and Methods

2.1. Preliminary study: Development of rice-like grains

Four varieties of cassava from the Institute of Plant Breeding, University of the Philippines Los Baños and Visayas State University, Leyte namely Lakan 1, Lakan 2, Binulak and Rajah 4 were used in the study. These were combined with different varieties of corn— IPB Var 6, IPB Var 8, IPB Var 11, IPB Var 13 and Camotes. Eleven (11) cassava-corn composites (100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90, and 0:100) for each paired combination were made into rice-like grains, making a total of two-hundred twenty (220) combinations. The rice-like grains were prepared similar to that of Hurtada et al. (2020) and Escobar (1992). The rice-like grains were prepared by mixing 100g flour composite with 30g egg white and 45mL distilled water. The dough was then placed in a pasta maker and cut into 10-mm pieces. The product was then steamed and dried. After which, the dried pellets were subjected to the Satake mill, an abrasive mill used to achieve the rice-like shape. Formulations that formed dough and retained their discreet rice-like grain shape when cooked were considered for sensory evaluation.

Sensory evaluation served as the basis for the selection of rice-like grains for consumer studies. According to Watts et al. (1989), in-house consumer panels usually consist of 30 to 50 untrained panellists. In this study, forty-five (45) volunteers were recruited for each combination and employed a completely randomised design for a sample presentation. The panellists were recruited based on age criteria (20-45 years old) and that they were not experiencing any illness

such as coughs, colds, or sore throat at the time of the study. The evaluation was carried out in a well-lit room where fifteen (15) grams or one tablespoon of boiled rice-like grains was served in small plastic cup containers. The panellists evaluated eleven (11) coded and randomised samples which were divided into three sessions. Panellists were provided with a glass of water and were instructed to rinse and swallow water between samples. Before sensory evaluation, interested panellists were given an informed consent form. Panellists were asked to evaluate the sensory characteristics (colour, aroma, texture and flavour) and overall liking of each sample. The sensory evaluation method used was a 15-cm line scale, as indicated by Lawless and Heymann (2003). Anchors used for each attribute are the following; (1) Colour – white to golden yellow; (2) Aroma – bland to strong; (3) Texture – sticky to firm; and (4) Flavour – starchy to cooked rice. On the other hand, the overall liking of the sample ranged from dislike to like.

2.2. Consumer acceptability

A cross-sectional study was carried at the community hall of Barangay Dayap, Calauan, Laguna, which included consumer testing of rice-like grains. The study was done in four consecutive days. One-hundred twenty (120) adult panellists were recruited from the said barangay. Criteria of panellists that were included in the study were: (1) should be of legal age; (2) were mothers or caregivers with pre-school children; (3) did not have any allergies to cassava, corn and egg; and (4) should be a resident of Barangay Dayap. Before the sensory evaluation, panellists were asked to sign an informed consent form explaining the nature of the study, voluntary participation, and non-disclosure of any identifying information.

The most acceptable ratios for each cassava-corn varietal combination (19) were used in consumer acceptability. Coded samples were randomly presented, four products a at time. Consumers rated acceptability for four (4) sensory attributes including colour, aroma, texture, and flavour using a 5-point hedonic scale. Acceptability was further evaluated using a binomial scale (yes or no) based on the following parameters: overall acceptability, comparability with rice, household preference, and their willingness to purchase. The perceived selling price of the respondents was also determined.

2.3. Statistical analysis

Data gathered from sensory evaluation and consumer testing were analysed using Analysis of Variance (ANOVA) and Kruskal Wallis, respectively. Whereas descriptive analysis was used for the demographic data. If the treatments were significant, Tukey's studentised range test and Bonferroni test were employed for further data analysis at 5% level of significance. Lastly, the relationship of consumer preference, willingness to pay, and the perceived price was determined using Spearman correlation. All statistical data were processed using the SPSS version 20 software.

3. Results and Discussion

3.1. Preliminary Study: Acceptability of rice-like grains

3.1.1. Binulak and different corn combinations

Rice-like grains made from the combination of Binulak and different varieties of corn are illustrated in Figure 1. For Binulak and Camotes combination, the ratio with the highest degree of liking is that of 80:20, whereas, pure Camotes had the lowest acceptability rating. This result indicates that for Binulak-Camotes rice-like grains, the overall liking seems to decrease as the proportion of Camotes increases. It was also noted that the overall likability of Binulak and Camotes combination had a positively weak association with its flavour. However, only the flavour exhibited a significant association among the sensory characteristics.

With IPB Var 6 corn, panellists still perceived a lower degree of liking as the corn proportion increased, the lowest liking was that of 10:90 combination and the highest for 50:50 of Binulak and IPB Var 6 grains. For this combination, it was found that colour ($r=0.247$, $p<0.01$), texture ($r=-0.275$, $p<0.01$), and flavour ($r=0.509$, $p<0.01$) had a positively weak, negatively weak and positively moderate correlation with overall likability, respectively. The findings suggest that for Binulak and IPB Var 6 combinations, grains close to golden yellow in colour, slightly less firm, and with cooked rice flavour were more liked by panellists.

Grains of Binulak and IPB Var 8 had the highest overall likability 80:20 proportion and lowest at 30:70.

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Correlation revealed that texture (r=0.114, p<0.01) and flavour (r=0.349, p<0.01) are the characteristics that are significantly related to the overall likability of Binulak and IPB Var 8 blends. On the other hand, the blend of 90:10 Binulak and IPB Var 11 was most liked by the panellists and 50:50 the least liked. A very weak relationship between aroma (r=0.161, p<0.01) and overall likability was realised for Binulak and IPB Var 11. Similar findings were observed with texture (r=0.101, p<0.05). In addition, higher acceptability was noted with samples having a flavour close to that of cooked rice (r=0.411, p<0.01). In the same way, blends with IPB Var 13 also revealed that grains that have firmer texture (r=0.161, p<0.01), stronger aroma (r=0.111, p<0.05), and closer to that of cooked rice flavour (r=143, p<0.01) were more likeable. The combination with the highest likability was 80:20 while 20:80 was the lowest.

3.1.2. Lakan 1 and different corn combinations

Among the varieties of corn combined with Lakan 1, the blend with IPB Var 8 had the highest degree of liking (Figure 2). For Lakan 1 and Camotes combination, a decreasing likability was observed as the proportion of corn increased. One hundred per cent (100 %) Lakan 1 had the highest degree of liking, followed by the blend with 20% Camotes. The overall likability of Lakan1 and Camotes blend is significantly (p<0.01) related to all the sensory attributes tested showing that a less white (r=0.406), strong aroma (r=0.311), less firm texture (r=-0.246), and cooked rice flavour (r=0.158) had a higher degree of liking.

On the other hand, for the blends with IPB Var 6, 60:40 combination had the highest likability rating with colour (r=0.137, p<0.01), aroma (r=0.154, p<0.01), and flavour (r=0.384, p<0.01) having a significant positive correlation. A decreasing likability trend was also seen in blends with IPB Var 11, with 90:10 cassava to corn ratio the highest, while 90:10 for blends with IPB Var 13. Whereas, the 50:50 combination garnered the most acceptable rating for blends of Lakan 1 and IPB Var 8.

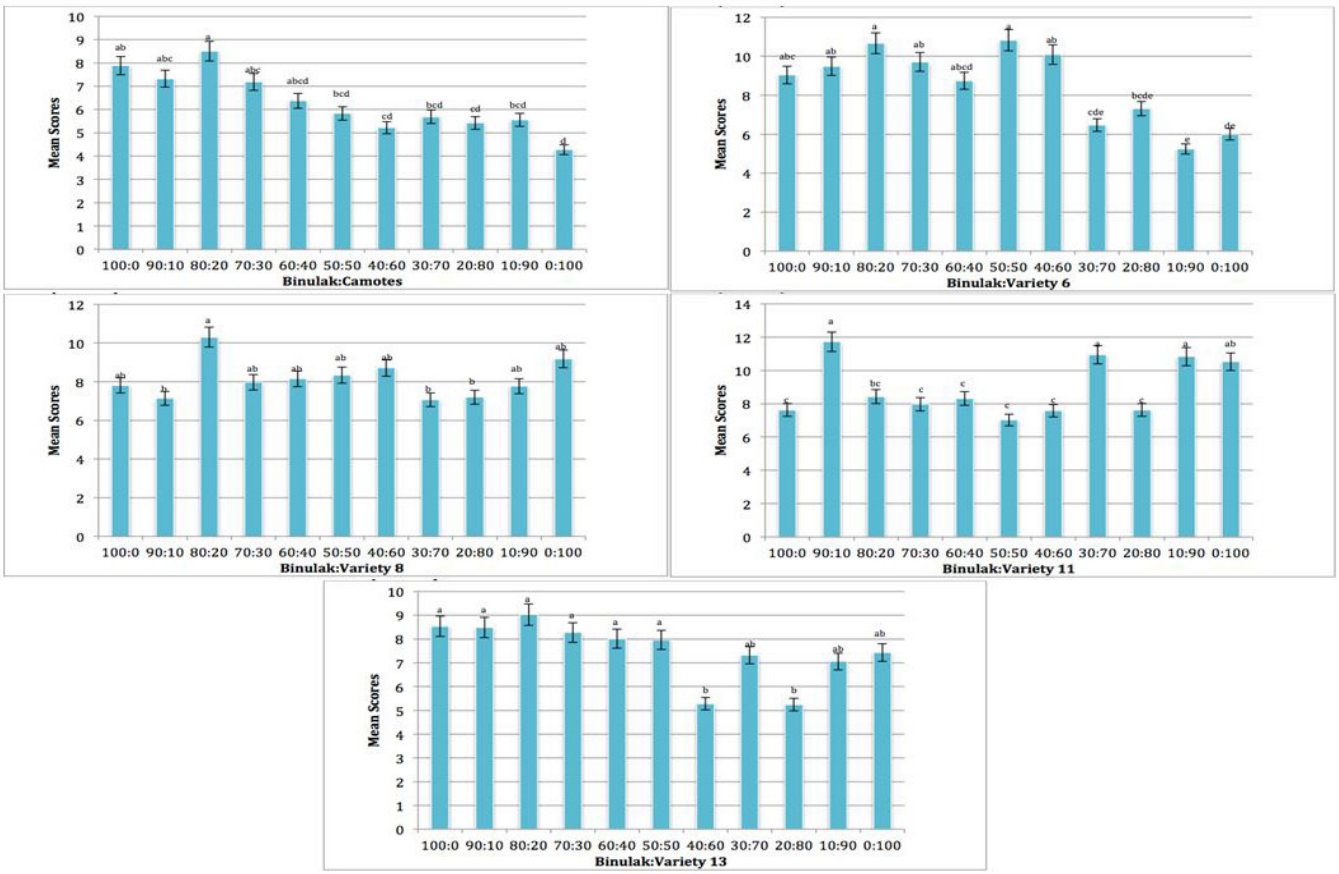

Figure 1. Over-all likability of Binulak rice-like grains

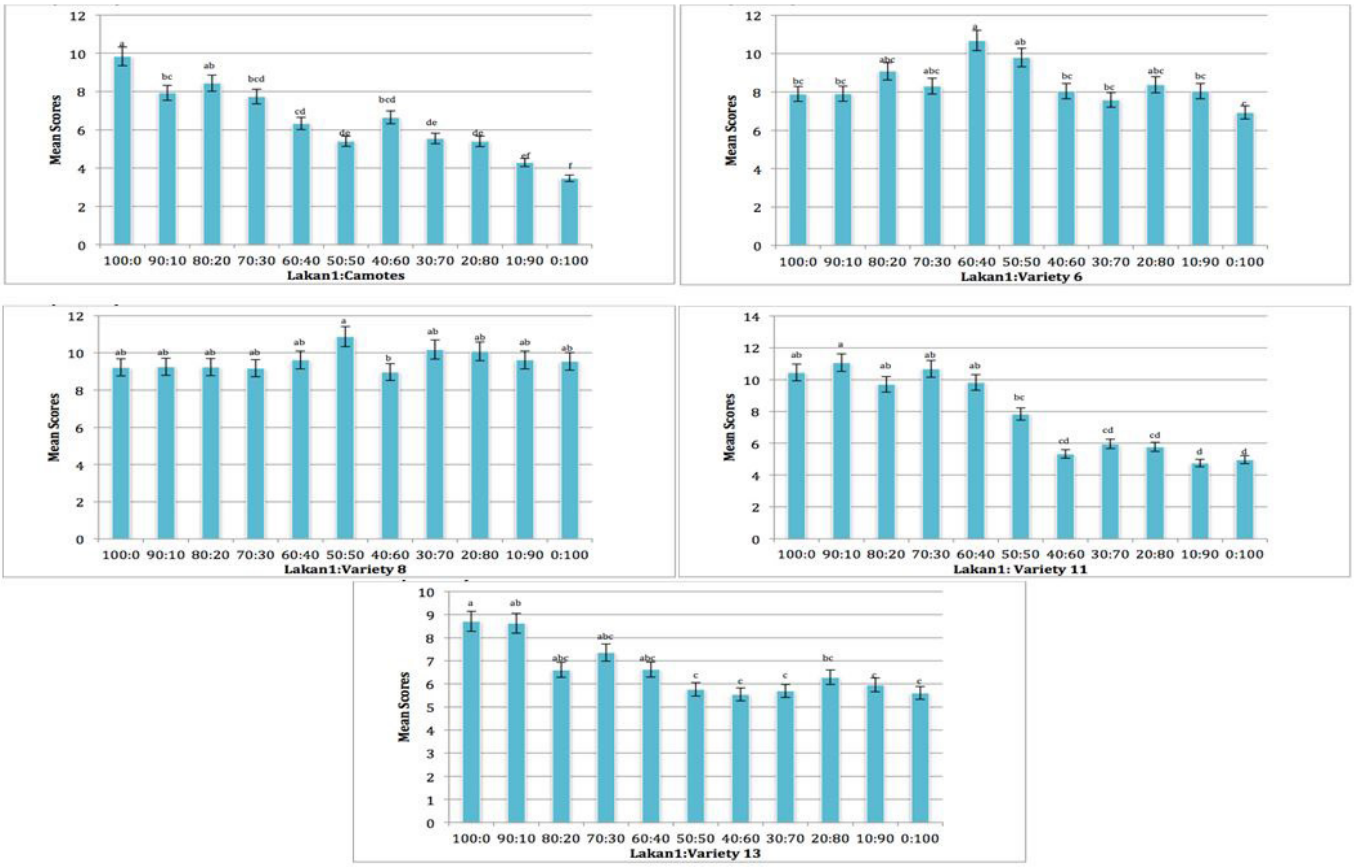

Figure 2. Overall likability of Lakan 1 rice-like grains

3.1.3. Lakan 2 and different corn combinations

Figure 3 shows the overall acceptability of Lakan 2 combinations. It was noted that higher amounts of Lakan 2 had a higher degree of liking compared to those with high corn proportions. For the blends with Camotes corn, 90:10 Lakan 2 and Camotes combination had the highest likability score where panellists perceived that a flavour close to the cooked rice ($r=0.359$, $p<0.01$) was more likeable. Similarly, combining Lakan 2 with IPB Var 13 also resulted in 90:10 being the most likeable blend with all attributes significantly correlated with overall likability. A whiter ($r=-0.125$, $p<0.01$), more aromatic ($r=0.271$, $p<0.01$), softer ($r=-0.229$, $p<0.01$), and stronger cooked rice flavour ($r=0.381$, $p<0.01$) were considered more likeable by the panellists.

Twenty per cent (20 %) Variety 11, on the other hand, turned out to have the highest likability among its blends. The same results as Lakan 2 and IPB Var 13 combination were generated for the correlation of likability with the sensory attributes tested. For blends with IPB Var 6, 70:30 was rated as most likeable, where more golden yellow colour ($r=0.306$, $p<0.01$), softer texture ($r=-0.354$, $p<0.01$), and less starchy flavour ($r=0.422$, $p<0.01$) of cooked grains were regarded as more acceptable. Conversely, it was 40:60 Lakan 2 and IPB Var 8 combination with the highest degree of liking for the blends of IPB Var 8 while 50:50 ratio was most liked for Lakan 2 and IPB Var 11 combination.

3.1.4. Rajah 4 and different corn combinations

Camotes and Rajah 4 combination showed that the more corn was added, the least the grains were liked (Figure 4). The 80:20 combination of cassava and corn had the highest degree of liking, and all sensory attributes were significantly related to overall likability ($p<0.01$). Whereas for grains with IPB Var 6, only colour ($r=0.098$, $p<0.05$) and flavour ($r=0.467$, $p<0.01$) were related to the overall likability of the blends, indicating that grains closer to golden yellow and cooked rice flavour were more acceptable. Grains with 100% Rajah 4 were most acceptable followed by their 90:10, cassava and IPB Var 6, combination.

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Comparable to Rajah 4 and Camotes combination, blends with IPB Var 8 also resulted in 80:20 having the highest degree of liking. It showed that a less white (r=0.327, p<0.01), softer texture (r=-0.170, p<0.01), and closer to cooked rice flavour (r=0.202, p<0.01) grains were more likeable. On the contrary, all sensory attributes were related to overall likability for blends with IPB Var 13, namely colour (r=0.251, p<0.01), aroma (r=0.307, p<0.01), texture (r=0.371, p<0.01), and flavour (r=0.537, p<0.01). Also, 70:30, Rajah 4 and IPB Var 13 had the highest mean score for acceptability. For Rajah 4 and IPB Var 11 combination, a higher corn proportion that was 40:60 was the most acceptable. Interestingly, this ration was the reverse from all other blends.

3.2. Consumer's acceptability of rice-like grains

3.2.1. Profile of respondents

A total of 120 rice-consuming mothers and caregivers of pre-school children participated in the study. Almost all of the respondents were female (99.2 %). The age of the mothers and caregivers largely varied as half of them (50 %) were above 40 years old, 31 out of 120 (26%) were between 31 to 40 years old, 27 out of 120 (23 %) were between 21 to 30 years old, and only two of them were under 20 years old. About thirty-eight per cent (38 %) of them belong to a household composed of five to six members, and about thirty per cent (30 %) belong to a household of three to four members. The majority of the respondents (61 %) have an average monthly income of less than €87 (Php 5,000), while 32 of 120 (27 %) have an average monthly income of €87 to €174 (Php5,000 to Php10,000). Despite the majority of the population belonging to a large household size with low average monthly income, eighty-two per cent (82 %) of the households eat rice thrice a day.

3.2.2. Degree of liking of sensory attributes

Rice-like grains with the highest acceptability scores for each cassava-corn combination were subject to consumer testing. The degree of liking of the attributes colour, aroma, texture, and flavour was determined

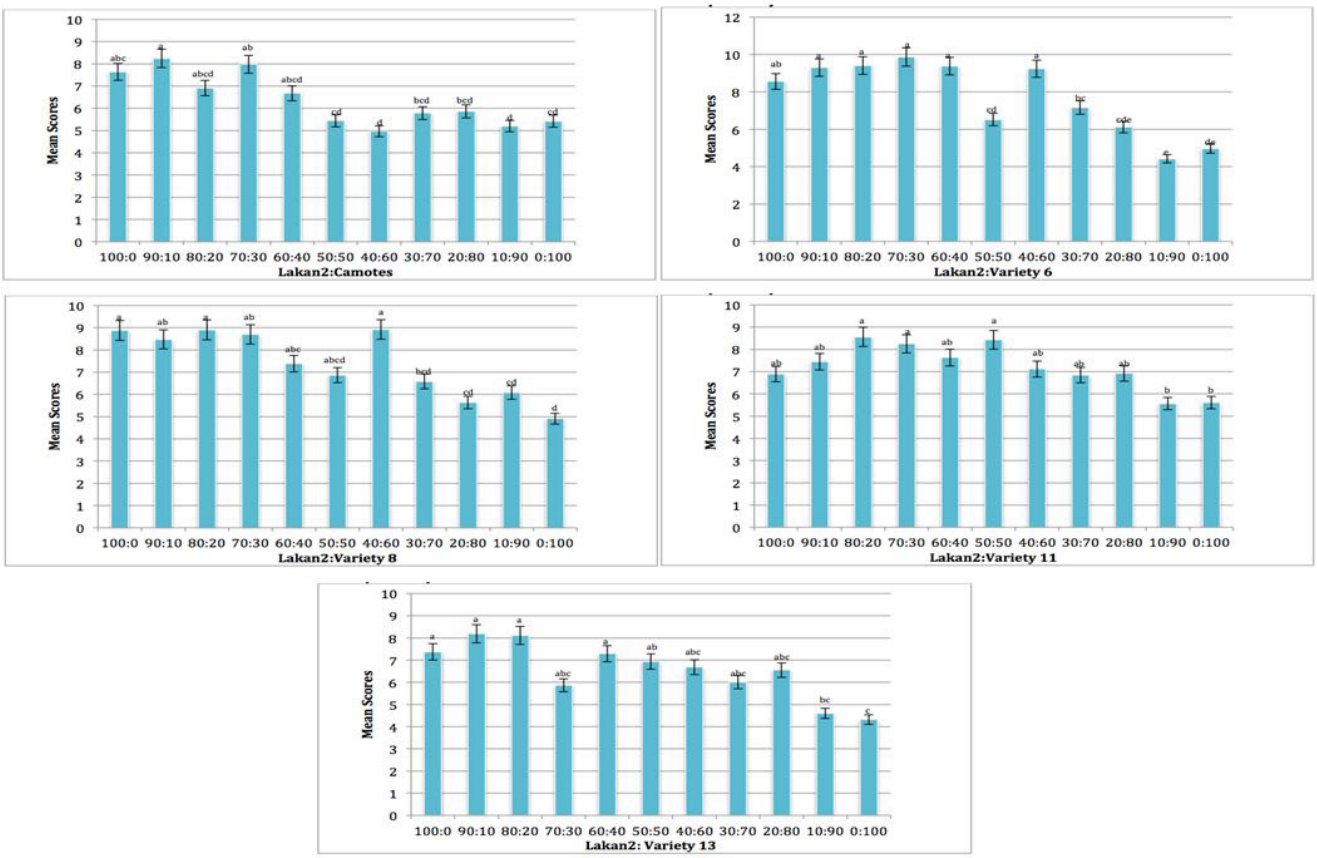

Figure 3. Over-all likability of Lakan 2 rice-like grains

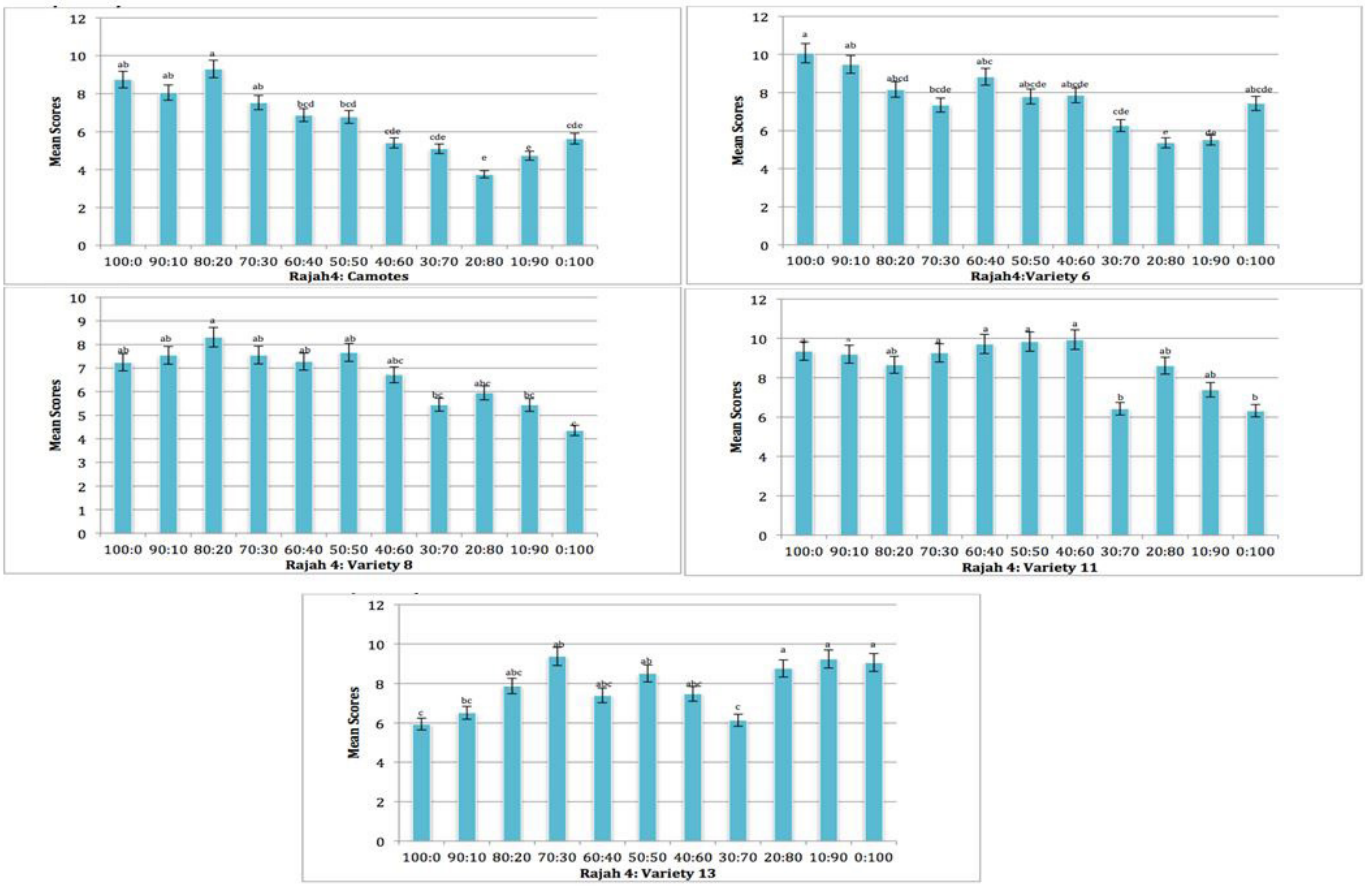

Figure 4. Over-all likability of Rajah 4 rice-like grains

using a 5-point hedonic scale (Table 1). Consumers usually assess the initial quality of a product by its colour and appearance, thus colour or appearance are the primary indicators of perceived quality (Lawless & Heymann, 2010). In rice quality, whiteness and translucency are important, with whiteness ranging from white to yellow. The whiteness of rice increases sharply during milling, while yellowness occurs during ageing (IRRI, 2006; Juliano et al., 2004).

Interestingly, for rice-like grains, the combination that ranked highest (mean rank =1384.80) in colour likability is a mix of white-fleshed cassava (Lakan2) and yellow corn (IPB Var13). In terms of aroma, Binulak: IPB Var 6 had the highest mean rank likability score (mean rank =1335.28) while Rajah 4 and Camotes combination significantly ranked the lowest among all treatments ($p<0.05$). The high likability score may be attributed to the strong aroma of the Binulak cassava when cooked (Hurtada et al.., 2020). Findings of the study done by Somthawil and Sriwattana (2016) concur, stating that strong aroma in rice coincided with high acceptance scores.

The aroma of cooked rice may be described as hay-like or musty, popcorn, corn, beany, dairy, sweet-aromatic, grassy, vanilla, sewer, animal, metallic and floral (IRRI, 2006). The Lakan2: IPB Var 13 combination scored the highest rank in texture likability (mean rank=1366.67). Texture is described as what is experienced in the mouth when eating rice. Stickiness, roughness, and springiness are the major traits that distinguish the texture of rice (Champagne et al., 2010). The most acceptable combination in terms of flavour is the mix of Binulak and IPB Var 6 (mean rank =1354.84) as well as the aroma. Aroma and flavour are significantly related attributes (Lawless and Heymann, 2010). Flavour in fragrant rice is produced by volatile compounds, many of which are volatilised during cooking to produce an aroma. Other sensory descriptors for rice are cardboard-like, starchy, metallic, and over-all rice impression (Meullenet et al., 2000). The lowest-ranked were Rajah 4: Camotes and Binulak: IPB Var 11. Common characteristics shared by Rajah 4: Camotes and Binulak: IPB Var11 were hardness and colour of grains. Products were described as hard ("matigas") and uneven coloured ("hindi pare-pareho ang kulay").

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Table 1. The mean rank scores of the consumer degree of liking for the sensory attributes of cooked rice-like grains

Combination	Colour	Aroma	Texture	Flavour
Lakan1: IPBVar6	1089.09^{bcd}	1159.50^{bcdefg}	1204.62^{fgh}	1169.19^{cdef}
Lakan1: IPBVar8	1072.94^{bc}	1085.20^{abcde}	1161.40^{bcdefg}	1056.65^{bcde}
Lakan1: IPBVar11	1107.70^{cde}	1088.43^{abcde}	1172.40^{bcdefg}	1182.66^{cdef}
Lakan1: IPBVar13	931.73^{b}	1038.19^{abcd}	1087.01^{bcdef}	1046.55^{bcd}
Lakan1: Camotes	1200.57^{cdef}	1173.81^{defg}	1194.89^{defgh}	1191.14^{def}
Lakan2: IPBVar6	1116.35^{cde}	1189.93^{defgh}	1099.05^{bcdefg}	1142.68^{bcde}
Lakan2: IPBVar8	1253.72^{efg}	1177.74^{defgh}	1240.23^{fgh}	1188.22^{def}
Lakan2: IPBVar11	948.43^{b}	1008.85^{ab}	1041.72^{bcde}	1029.64^{bc}
Lakan2: IPBVar13	1384.80^{g}	1293.38^{gh}	1366.67^{i}	1312.96^{fg}
Lakan2: Camotes	1076.79^{bc}	1209.65^{efgh}	1197.35^{efgh}	1143.30^{bcde}
Rajah4: IPBVar6	1158.15^{cde}	1146.57^{bcdefg}	1187.48^{cdefgh}	1207.82^{efg}
Rajah4: IPBVar8	1216.56^{cdef}	1250.26^{fgh}	1333.16^{hi}	1310.60^{fg}
Rajah4: IPBVar13	1243.61^{defg}	1108.78^{bcdef}	1099.86^{bcdefg}	1156.45^{cde}
Rajah4: IPBVar11	1127.54^{cde}	1124.03^{bcdef}	1022.60^{b}	1096.35^{bcde}
Rajah4: Camotes	769.82^{a}	944.61^{a}	1031.36^{bc}	987.42^{b}
Binulak: IPBVar6	1335.28^{fg}	1318.23^{h}	1247.91^{ghi}	1354.82^{g}
Binulak: IPBVar8	1355.43^{fg}	1204.45^{efgh}	1131.72^{bcdefg}	1127.75^{bcde}
Binulak: IPBVar11	1072.41^{bc}	1016.62^{abc}	812.43^{a}	841.45^{a}
Binulak: Camotes	1208.60^{cdef}	1131.27^{bcdef}	1037.63^{bcd}	1123.84^{bcde}

$^{a-i}$ Mean scores with the same letter within the same column are not significantly different using Bonferroni test ($p<0.05$).

3.3. Relationship of acceptability, willingness to purchase, household preference, and perceived price

Based on overall acceptability, the majority (81.7 %) of the respondents preferred Lakan 2: IPB Var 13 (90:10) over the other combinations. It was the same sample that gave the highest score in terms of comparable characteristics to rice. Descriptors used were delicious ("masarap") and tastes and smells like rice ("amoy at lasang kanin"). However, when asked if other household members will consume the product, Binulak: IPB Var 6 (50:50) was favoured by most (78.3 %). Furthermore, about eighty-seven per cent (87 %) of them chose to buy the same sample. In general, characteristics preferred by the respondents were rice-like grains which were lighter in colour, softer and fluffier in texture, with a slightly bland taste. Rajah 4: Camotes (80:20) produced unevenly coloured grains, some appearing darker.

Figure 5 illustrates the relationship between acceptability scores, willingness to purchase, household preference, and perceived price. A strong positive correlation was realised between colour and aroma ($r=0.700$, $p<0.01$); and between flavour and texture ($r=0.716$, $p<0.01$). In terms of acceptability parameters, a strong positive correlation was found between overall acceptability and its comparability to rice ($r=0.753$, $p<0.01$). A moderately strong positive correlation exists between overall acceptability and individual

sensory attributes such as colour (r=0.467, p<0.01), aroma (r=0.468, p<0.01), texture (r=0.533, p<0.01), and flavour (r=0.583, p<0.01). Likewise, a moderately strong positive correlation was observed between comparability to rice and all sensory attributes. All sensory attributes shared a moderate to strong positive correlation which means consumers take colour, aroma, texture, and flavour as one. Additionally, the strong positive correlation between overall acceptability and comparability with rice implies that the consumers rated the product's acceptability based on the similarities to rice. Filipinos share a general preference to rice in which it should be long-grained, translucent, white, well-milled, aromatic, and soft when cooked (Juliano et al., 2004; de Leon, 2005).

There was also a strong positive correlation between the perceived household preference and willingness to purchase (r=0.779, p<0.01). Mothers and caregivers were more likely to purchase what they thought the household prefers (r=0.779, p<0.01) over personal liking, as evidenced by a weak positive correlation (r=0.177, p<0.01). However, it must be noted that both parameters remained significant. Household food decision-making is a joint activity determined by family dynamics and how active children participate in the process (Hall et al., 1995; Noorgard et al., 2007). The overall acceptability among mothers and caregivers contributes to the potential marketability of the product. However, the household acceptability of the product is of more vital importance.

The price-quality relationship can be discussed based on two viewpoints; one is based on consumer perception and the other on market positioning (Judd, 2000). In terms of perceived price, a high value (>€0.87) meant that the product was deemed of higher quality, while a low value (<€0.52) meant that the product was deemed of lesser quality. In Metro Manila, rice of higher quality and price are the dinorado and milagrosa varieties, while rice from the Philippine National Food Authority was known to be the cheaper alternative (Aguilar, 2005). Such varieties commonly found in markets were expected to serve as benchmarks.

There was a weak positive correlation between price and all sensory attributes. Quality can be translated to sensory attributes such as colour, aroma, texture, and flavour. Among all sensory attributes, colour had the highest positive correlation with price (r=0.094, p<0.01). However, there was no significant relationship between perceived price and overall acceptability as well as the comparability to rice. Based on the lack of significant correlation, it can be inferred that the rice-like grains were taken as a new product rather than as a substitute. The perceived price weakly reflects quality in terms of sensory attributes. While perceived price, in this study, cannot be used as an indicator of overall acceptability. Binulak: IPB Var 6 was perceived to be comparable to the cost of rice, which was between €0.52 to €0.87 (Php30 to Php50). On the other hand, cassava rice-like grains with Rajah 4 show a low perceived cost of fewer than €0.52 (Php30).

Variables	Color	Aroma	Texture	Flavor	Comparable to Rice	Overall Acceptability	Willingness to Purchase	Household Preference	Perceived Price
Color									
Aroma	.700**								
Texture	.593**	.631**							
Flavor	.605**	.646**	.716**						
Comparable to Rice	.425**	.421**	.490**	.540**					
Overall Acceptability	.467**	.468**	.533**	.583**	.753**				
Willingness to Purchase	.204**	.152**	.172**	.162**	.168**	.177**			
Household Preference	.165**	.119**	.126**	.120**	.124**	.139**	.779**		
Perceived Price	.094**	.048*	.044*	.047*	0.037	0.017	.257**	.212**	

Legend: 1, 0.75, 0.5, 0.25, 0

Figure 5. Correlation matrix heat map of consumer acceptability scores, willingness to purchase, household preference and perceived price (*significant at p<0.05; ** significant at p<0.01)

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4. Conclusion

Cassava, a widely grown, carbohydrate-rich crop, was combined with corn, which is recognised to be the second most important crop in the country, to produce rice-like grains. In the consumer acceptability test, Binulak: IPB Var 6 ranked highest in aroma and flavour, while Lakan 2: IPB Var 13 ranked highest in terms of colour, texture, and overall acceptability. Characteristics shared among these products were its soft and glutinous texture, light yellow colour, bland taste, and the consistency of the shape of the grains. However, the majority's perceived price of the product regardless of the variety is less than €0.52, which was lower than that of rice. Significant correlations showed that there was a strong relationship between and among sensory attributes and overall acceptability of the product. Perceived price, among all the parameters, did not reflect a significant correlation with overall acceptability as well as its comparability to rice. While perceived price alone cannot be used as a basis for overall acceptability and marketability, household preference makes it more likely for mothers and caregivers to buy the product. The acceptability ratings, in terms of sensory attributes and perception, indicate that rice-like grains from cassava and corn are a viable alternative to rice. Other carbohydrate-rich crops, both widely grown and indigenous may be utilised to produce rice-like grains. Consumer acceptability among children under-five may also be explored to promote household food consumption and consequently address malnutrition.

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Conflict of Interest

Authors declare no conflict of interest. The funding agency had no role in the design, collection, analysis, interpretation, and writing of the manuscript.

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Research Paper

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An exploration on factors influencing certified and farm-saved seed use: a case study in Turkish wheat farming

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Seeds are an important input for wheat-growing, as is the case for all crop production. The type and quality of seed in crop production are the first condition for productivity and accordingly certified wheat seed use is being encouraged by the government since 2005 in Turkey. This study examined the factors affecting the certified seed and farmer (farm)-saved seed use in wheat farming in Turkey. The result of the analyses showed that there is a significant difference between farmers using certified seed and farm-saved seed, considering farmer experience, the purpose of wheat growing, the status of a farmer concerning system registration, agricultural credit use, size of total farmland and size of wheat cultivation area. As a result, it can be inferred that high-quality wheat production is associated with the use of certified seeds. In this context, maintaining the certified seed support is important for increasing of certified seed use.

1. Introduction

The Turkish agriculture sector constitutes 7.8% of gross domestic product, employs 21.2% of its total labour, and creates 11.4% of total export value (TURKSTAT, 2018). Wheat, one of the most important crops for the Turkish economy, is an essential basic food consumed mostly in the form of bread in Turkey. Wheat is also used as animal feed and as an input to make various foods in the industry. Therefore, wheat is a strategic crop for food security in Turkey, especially for smallholder farmers (Yilmaz et al., 2016).

Wheat is grown on about 7.6 million ha, and approximately 20.6 million tons of wheat is produced in Turkey annually. Wheat occupies the primary position among the cereal crops in Turkey both in terms of area and production amount (TURKSTAT, 2018). While wheat production amounts had risen steadily between 1961 and 2016, the wheat production area has been decreasing. Most of the rise in wheat production was due to higher yields per hectare. In 1961, the yield was 909 kg/ha. It reached 2,292 kg/ha by the early 2000s and climbed to 2,707 kg/ha in 2016 (FAOSTAT, 2018). It is reported that both the genetically improved cultivars for yield and better cultural methods contributed to the yield improvement, but it is difficult to quantify the effects of each. The actual yield that is obtained on the farm depends on several factors such as the crop's genetic potential, seed variety, seed quality, the amount of sunlight, water and nutrients absorbed by the crop, the presence of weeds and pests (FAO, 2018). In crop production, the use of superior, high-quality ad certified seed leads to rising crop yields by around 20-30 %, depending on other conditions of production (Koksal & Cevher, 2015; Aksoy et al., 2017).

It is important to point out that the seed industry uses several mechanisms to reduce competition from traditional farmers' seeds. One of these mechanisms is

the seed laws that constitute the most critical factor in many countries. By making seed certification mandatory and announcing the trade of uncertified seeds (farm-saved seed) illegal, governments indirectly support commercial seeds against traditional seed-exchange systems (GRAIN, 2007). Certified wheat seed provides significant yield gains. However, while prices are volatile over time, production costs rise continuously. Whenever costs rise, or wheat prices decline, producers search for ways to reduce costs without incurring a considerable reduction in yields.

It is paramount to understand factors such as management of crop and seed to achieve high wheat yields (Freiberg et al., 2017). The seed represents the main intensification factor for the achievement of high yields and production quality. Therefore, the production of high-quality wheat is associated with the use of certified seeds. Accordingly, the Turkish Ministry of Agriculture and Forestry (MAF) has been providing area-based supports to farmers to promote the domestic production of certified seed since 2005. Within this subsidy system, a farmer who plants wheat with domestically produced and certified wheat seed is allowed to receive 85 TRY per hectare using the 2017 exchange rate 3,65 Turkish Lira (TRY) to the US$1. MAF has also been providing subsidies to seed producers for certified seed production in Turkey (TOJ, 2017). Turkish farmers have been using fewer and fewer saved seeds, but the practice still represents the majority of seed sources for wheat production. However, about 35% of the total wheat seed used each year is certified. The seed sector in Turkey has grown rapidly since the new seed law entered into force in 2006. Both the government and private sectors' production capacity has increased with the help of government supporting policies for certified seed use and domestic seed production (USDA, 2017).

Many studies have been conducted on seed use of farmers and the evolution of the seed sector in Turkey and other relevant countries (Grain, 2007; Tanrivermis & Akdogan, 2007; Clayton et al., 2009; Sichali et al., 2013; Curtis & Halford, 2014; Koksal & Cevher, 2015; Gul et al., 2015; Nardi, 2016; Spielman & Kennedy, 2016; Joshi et al., 2016; Adalıoglu et al., 2017; Aksoy et al., 2017; Kart et al., 2017; USDA; 2017; Furtas, 2018; Gungor et al., 2018; Cevher & Altunkaynak, 2020). This study examined the factors affecting farmers' use of government-supported certified seed and farm-saved seed in wheat farming in Burdur and Isparta provinces located in the Lakes Region of Turkey. This study examined factors affecting farm-saved seed use of wheat farmers for the first time. It also aimed to fill the information gap on farm-saved seed use. Therefore, the study was conducted to contribute to the literature by adding original values.

2. Material and methods

2.1. Data collection

Isparta and Burdur provinces were chosen as representatives for the Lakes Region of Turkey's wheat production area since wheat farming is one of the most common economic activities. Karaaliler and Kızılkaya villages in Bucak district of Burdur; Hüyüklü and Eğirler villages in Yalvac district of Isparta provinces which are dominant in wheat production were chosen (Figure 1). A list of farmers growing wheat was obtained from the Agriculture and Forestry Directorates of Isparta and Burdur to be used for sample size calculation. The sample size was determined as 88 for the simple random sampling method (Yamane, 2001) using Eq. 1.

$$n = \frac{N * s^2 * t^2}{(N-1) * d^2 + s^2 * t^2} \qquad \text{(Eq. 1)}$$

Where: n=sample size; s=standard deviation; t=t value with a 95% confidence interval (1.96), N=total farm number in the sample population (489 farm), d=acceptable error (5% deviation).

Following sample size determination, data were collected in January 2017 using structured interviews with 88 randomly selected wheat producers. The collected data were divided into two groups before analyses. This divide allowed for a comparative analysis of both certified seed and farm-saved seed use by farmers.

2.2. Data analysis

This research was carried out with 88 farmers; collected data were divided into two groups before analyses. Group 1 farmers were using certified seed (64 farmers), and group 2 farmers were using farm-

saved seed (24 farmers). In the scope of this study, descriptive statistics were used to understand the nature of the sample. Chi-square test was used to analyse differences between groups depending on the normality of the data. SPSS 20 was used for data analysis. The chi-square ($\chi 2$) test statistic is given below (Eq.2) (Koseoglu and Yamak, 2008).

$$\chi^2 = \Sigma_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \qquad \text{(Eq. 2)}$$

Where: χ^2=calculated chi-square value, E_{ij}=expected frequency value, Oij=observed frequency value,

3. Results and discussion

3.1. General characteristics of the farms

The socioeconomic characteristics of farmers using certified seed or farm-saved seed were compared to understand the nature of the sample. Some basic characteristics of the sample farms are presented in Table 1.

Farmer's average age was 53.33 years for the certified seed users, and that of farm-saved seed users was 54.79. The educational level of farmers using certified seed was higher compared to farmers using farm-saved seed. Their experience in wheat farming was vast in both groups. The average experience of farmers using certified seed was 36.66 years, lower than (40.54 years) of farmers using farm-saved seed. The farm size area and wheat production area of farmers using certified seed was 9.79 ha and 5.11 ha, respectively. Their farm income per farm was TRY 53.125 on average. In contrast, the farm size area and wheat production area of farmers using farm-saved seed were 4.16 ha and 2.10 ha, respectively, and they received less farm income (TRY 26 041.67). The agricultural credit usage rate of farmers using certified seed was 67.19%, higher than the rate (20.83%) of farmers using farm-saved seed. The wheat yield of farms using certified seed (3.64 t ha-1) was higher compared to the yield of farms using farm-saved seed (3.33 t ha-1).

3.2. The result of the chi-square test analysis according to selected personal characteristics of the farmers and their information-seeking behaviour

Turkish farmers face many of the decisions every growing season. Seed selection is one of the principal farm management decisions. Wheat farmers need to allocate their budget properly for certified seed

Figure 1. Location of Burdur and Isparta Provinces

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use. Alternatively, they can allocate time, labour, and resources to clean their production and to use farm-saved seed. The factors that influence this decision are not always straightforward (Furtas, 2018). In this study, it was found that the rate of certified seed use among farmers was 72.73 % while the rate of farm-saved seed use was 27.27 % in wheat farming. In another study, the rates of certified seed use farmers in wheat farming were found as 34.70% in Burdur province and 69.3% in Isparta province (Gul et al., 2015). In another study, the rate of certified seed use farmers in wheat farming was 58.70% in Ankara province in Turkey (Cevher & Altunkaynak, 2020).

The use of certified or farm-saved wheat seed in farms can be associated with many factors, such as the personal characteristics of the farmers, their information-seeking behaviour, and farming characteristics. Table 2 shows the chi-square ($\chi 2$) test of differences between groups of selected personal characteristics of the farmers and their information-seeking behaviour in wheat farming. The result of the analyses showed that there is a significant difference between the farmers using certified seed and farmers using farm-saved seed, considering farmer's wheat farming experience ($p \leq 0.05$), the status of the farmer registration system, and agricultural credit use ($p \leq 0.01$). These findings suggest that registered farmers are provided more farming experience, and more agricultural credit use and raise the possibility of using certified seed.

In another study that investigated the socioeconomic characteristics of wheat producers on certified seed use in Turkey, it was found that the income levels of farmers had a significant ($p < 0.05$) effect on seed selection (Cevher & Altunkaynak, 2020).

Table 1. Main characteristics of surveyed farms

Characteristics	Farmers using certified seed (N=64)		Farmers using farm-saved seed (N=24)	
	Average	S.D	Average	S.D
Age (year)	53.33	13.34	54.79	9.90
Education (year)	7.11	2.96	6.96	3.29
Family size (person)	3.72	1.82	3.50	1.84
Farm income (TRY/farm)*	53 125.00	79 948.89	26 041.67	23 510.37
Experience (year)	36.66	12.63	40.54	11.31
The rate of the farmer membership in agricultural cooperative (%)	89.06		79.17	
The proportion of farmers using agricultural credit (%)	67.19		20.83	
Average farm size (hectare)	9.79	10.47	4.16	2.87
Owned land (ha)	8.51	10.59	3.26	2.55
Rented land (ha)	1.04	1.91	0.66	1.36
Common land (ha)	0.24	1.17	0.24	1.02
Wheat production area (hectare)	5.11	4.75	2.10	1.20
Wheat yield (tons/hectare)	3.64	7.78	3.33	5.67
Wheat Production (tons/farm)	18.77	18.35	6.99	4.39
Reserved for farm animals' consumption (tons/farm)	5.54	9.15	3.20	3.52
Reserved for household consumption (tons/farm)	1.58	5.14	0.57	0.74
Amount of wheat sold (tons/farm)	11.65	15.42	3.22	4.32

* using 2017 exchange rate 3.65 Turkish Lira (TRY) to US$1.

Table 2. Results of chi-square test (χ2) showing associations between groups by selected characteristics of surveyed farms

Characteristics	Farmers using certified seed (N=64)		Farmers using farm-saved seed (N=24)		Total (N=88)	
Personal characteristics	N	%	N	%	N	%
Age (year)						
< 60	42	65.63	16	66.67	58	65.91
60 and over	22	34.38	8	33.33	30	34.09
χ2 =0.008						
Education						
primary or middle school	48	75.00	18	75.00	66	75.00
high school or university	16	25.00	6	25.00	22	25.00
χ2 =0.000						
Experience (year)						
< 30	32	50.00	6	25.00	38	43.18
30 and over	32	50.00	18	75.00	50	56.82
χ2 =4.446**						
Family population (person)						
< 3	35	54.69	14	58.33	49	55.68
3 and over	29	45.31	10	41.67	39	44.32
χ2 =0.094						
Cooperative membership of farmer						
Yes	57	89.06	19	79.17	76	86.36
No	7	10.94	5	20.83	12	13.64
χ2 =1.451						
With livestock on the farm						
Yes	49	76.56	20	83.33	69	78.41
No	15	23.44	4	16.67	19	21.59
χ2 =0.473						
Registration of the farmers in the farmer registration system						
Yes	59	92.19	17	70.83	76	86.36
No	5	7.81	7	29.17	12	13.64
χ2 =6.758***						
Agricultural credit use						
Yes	43	67.19	5	20.83	48	54.55
No	21	32.81	19	79.17	40	45.45
χ2 =15.127***						
Information-seeking behavior						
Participation in agricultural extension activities about wheat growing						
Yes	17	26.56	8	33.33	25	28.41
No	47	73.44	16	66.67	63	71.59
χ2 =0.393						
Participation in the extension meeting about certified seed use						
Yes	32	50.00	12	50.00	44	50.00
No	32	50.00	12	50.00	44	50.00
χ2 =0.000						
Information sources of farmers about seed use						
Directorate of agricultural extension services	31	48.44	12	50.00	43	48.86
Agricultural cooperative	11	17.19	4	16.67	15	17.05
Seed dealers	22	34.38	8	33.33	30	34.09
χ2 =0.229						

**p ≤ 0.05, *** p ≤ 0.01

3.3. Results of the chi-square analysis showing associations between groups by selected farming characteristics of the wheat farms

Certificated seed use decreases unit cost following higher crop yield. Hence, using certificated seed provides significant gains both to agricultural management and the region's and country's economy

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(Aksoy et al., 2017). Many variables influence farmers' use of certified or farm-saved seed in wheat production. These can be indicated by the purpose of wheat growing, size of total farmland and wheat cultivation area, wheat yield, agricultural combat method, and use of paid labour on the farm. Table 3 demonstrates the difference between groups of farmers by type of seed used, and these groups were formed by using selected farm characteristics. The empirical evidence revealed that there is a significant difference between the farmers using certified seed and farm-saved seed, considering the size of the wheat cultivation area ($p \leq 0.01$), the purpose of wheat growing, and the size of total farmland ($p \leq 0.10$). It implies that as the size of wheat cultivation area and farmland area rises and as more farmers produce wheat for commercial purposes, the possibility to use certified seed rises.

Farmers producing wheat for commercial purposes were more likely to prefer the use of certified seed than farmers producing wheat for domestic consumption purposes. Because it could be said that certified seeds are the only input for higher yields, more income and production can be achieved. One notable result of this study was that there was no significant difference between the seed types used in terms of seed yield. In some circumstances, soil structure, climate conditions, choosing the right wheat variety, and healthy wheat seeds and cultural precautions can be more effective on yield than seed type in wheat farming.

3.4. Farmers' opinions on fluctuations in the amount of wheat produced in the research region

Certified seed usage is quickly replacing farm-saved seed in Turkey, mainly because of the higher yield realised by producers and the subsidy policies applied. Some wheat farmers prefer farm-saved seed use either due to financial constraints or lack of knowledge on certified seed (USDA, 2017). Depending on subsidy policies for certified seed usage and the developments in the certified seed sector in Turkey, certified seed production and use has increased over the years (Bagcı & Yilmaz, 2016). Table 4 shows the farmers' opinions on major reasons for fluctuations in the amount of wheat produced. It was determined that 'climatic conditions as, drought', 'high input prices', 'wheat diseases', and 'low wheat prices' are the most important reasons in the fluctuations of the wheat amount produced. Reasons such as 'using insufficient fertiliser', 'problems caused by seed', and 'wheat pests' were found to be unimportant. The share of farmers indicating 'problems caused by seed' as an important factor was lower for farmers using certified seed with 15.63% than for farmers using farm-saved seed (37.50%).

Table 3. Results of chi-square test ($\chi 2$) showing associations between groups by selected farming characteristics of the farm

Characteristics	Farmers using certified seed (N=64)		Farmers using farm-saved seed (N=24)		Total (N=88)	
	N	%	N	%	N	%
Purpose of wheat growing						
Domestic consumption	24	37.50	14	58.33	38	43.18
Commercial	40	62.50	10	41.67	50	56.82
$\chi 2$ =3.088*						
Size of total farmland (hectare)						
< 5	30	46.88	16	66.67	46	52.27
5 and over	34	53.13	8	33.33	42	47.73
$\chi 2$ =2.741*						
Size of wheat cultivation area (hectare)						
< 3	25	39.06	16	66.67	41	46.59
3 and over	39	60.94	8	33.33	47	53.41
$\chi 2$ =5.345***						
Wheat yield (tons/hectare)						
1- 3.99	34	53.13	17	70.83	51	57.95
4 and over	30	46.88	7	29.17	37	42.05
$\chi 2$ =2.246						
Method of plant protection						
Biological control	9	14.06	4	16.67	13	14.77
Chemical control	55	85.94	20	83.33	75	85.23
$\chi 2$ =0.094						
Use of salaried labour force (non-family labour)						
Yes	35	54.69	10	41.67	45	51.14
No	29	45.31	14	58.33	43	48.86
$\chi 2$ =1.184						

*$p \leq 0.10$, *** $p \leq 0.01$

Table 4. Farmers' opinions on the major reasons for changes in the amount of wheat produced

Opinions*	Farmers using certified seed (N=64)		Farmers using farm-saved seed (N=24)		Total (N=88)	
	N	%	N	%	N	%
Climate conditions, drought	59	92.19	23	95.83	82	93.18
Input prices are high	56	87.50	22	91.67	78	88.64
Wheat diseases	55	85.94	21	87.50	76	86.36
Wheat prices are low	46	71.88	8	33.33	54	61.36
Using insufficient fertilizer	16	25.00	7	29.17	23	26.14
Problems caused by seed	10	15.63	9	37.50	19	21.59
Wheat pests	10	15.63	3	12.50	13	14.77

*Note: farmers were allowed to give multiple responses.

4. Conclusion

Wheat is one of the most important crops for human nutrition in Turkey and the world. Product quality and having high yields are related to the use of the high-quality seed. Therefore, the rising use of certified seeds with higher genetic potential is expected to increase quality and yield in wheat production. Since 2005, area-based supports are provided to farmers' using certified seed by the Ministry of Agriculture and Forestry in Turkey. These supports have been necessary for the improvement of certified seed use.

In this study, the factors affecting the government-supported certified and farmer (farm)-saved seed use in wheat farming were examined in Burdur and Isparta province, which is located in the Lakes Region of Turkey. Based on qualitative and quantitative analyses presented in this study, the following conclusions and recommendations can be withdrawn. Empirical evidence revealed that a larger size of wheat cultivation and farmland area and the amount of wheat produced for commercial purposes was positively correlated to certified seed use. Also, rising registries to the system, more farming experience, and more agricultural credit use raised the possibility of certified seed usage. Based on these results, it can be said that government subsidy policies play important roles in promoting certified seed use among farmers. Therefore, the government should continue to subsidise certified wheat seed use and promote extension work to increase wheat yield. In this way, certified wheat seed use in wheat farming will have practical means to improve wheat productivity and enhance food security.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Engaging stakeholders in traditional food products through dissemination of knowledge and innovation based in digital platforms

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The agrofood sector has a wide sectorial and business dispersion, constituting, in parallel, a relevant space of the European and national economy. In addition to the economic and social impact, the growth of the sector is an opportunity for the development of rural areas and agriculture, particularly given Europe's shortages in raw food materials. The need for continuous improvement, and market developments of this sector, require that innovation processes occur. These innovation processes have been facilitated by the development of information and communication technologies, and by the emergence of social networks that facilitate knowledge sharing. The NEWFOOD — Food Technologies Valorization Project is framed in the field of Knowledge and Technology Transfer and is oriented towards innovation in traditional food products. One of its objectives is to actively disseminate knowledge, skills and resources to the entities involved, including stakeholders from the relevant economic sectors.

This paper aims to identify and describe the role of social networks and other digital platforms used to meet this goal and the impact achieved. This research involved a single exploratory case study, with a conceptual knowledge management model and included primary data collected through documents developed for the NEWFOOD project, social networks/digital platforms, and observations of some project actions. Several digital contents were developed and distributed to bring innovators and researchers to promote innovations in traditional food products and to raise sector stakeholder's awareness about the potential of exploitation. Social media support tools associated with the project (Instagram, Facebook, Twitter, YouTube), and the platforms (Knowledge Portfolio, innovation platform) reached some 6000 followers/shareholders like students, entrepreneurs and other professionals in the sector. NEWFOOD project allowed the participation of 15 teams of stakeholders in an innovation program and contest and added innovation to 15 Portuguese traditional food products. Our results supported by the dissemination materials developed and by the social networks used contributed to promoting technological innovation and for generating of new ideas for products in this sector, and the alignment between stakeholders.

1. Introduction

Social media platforms have essentially become a medium, not only for communication among individuals but also for aspects of the business sectors, including decision making process (Choi et al., 2017), knowl-

edge-based decision support systems (Chen et al., 2012; Hashem et al., 2016), brand promotions (Kaplan & Haenlein, 2010), among others. Social networks have undergone a high growth over the last decade as a result of technological developments as well as evolutions of the Internet, which has created some of the most well-known social networks today such as Facebook, Instagram, Twitter and YouTube (Brennan & Croft, 2012). It changed patterns of interaction, communication, and personal habits and work routines, turning the world into that already known expression, "Global Village". Distance has become purely physical, and this digital space has become an ally in the daily life of society (Forman et al., 2005). Social networks are characterised by a large group of individuals who use a certain network, and in a way, are production and sharing of content (Kaplan & Haenlein, 2010). They have a high innovation potential, particularly when interacting with customers or the community (Ioanid et al., 2018).

The food and beverage industry plays a crucial role in the Europe Union (EU) economy; it employs 4.72 million people, generates a turnover of €1.2 trillion and €236 billion in added value, making it the largest manufacturing industry in the EU. In half of the EU's 28 Member States, the food and drink industry is the biggest manufacturing employer. About ¾ of EU food and drink exports are destined for the Single Market. At the same time, the EU is the largest exporter of food and drink products in the world with extra EU exports reaching €110 billion and a trade surplus of €36 billion (FoodDrinkEurope, 2019). In Portugal, data from 2016 reveal that this sector is composed of 11 089 companies (mostly in the North Region), employing around 110 thousand people, and has a turnover of €15.6 billion, equivalent to 4.6% of the total national industry. The sector is characterised by a high number of small and medium-sized enterprises. However, 70.6% of production is concentrated in medium and large enterprises (Instituto Nacional de Estatística, 2018). Thus, it appears that the agrofood sector has an important role in the Portuguese economy, still having high growth potential.

In the agrofood sector, as well as in other sectors of the economy, innovation is the main driver of productivity growth, competitiveness, and sustainability. In general, there is a consensus that innovation processes are not spontaneous or isolated, and they do not occur by decree. They occur in society and are conditioned by the level of internal development of that society, the accumulation of human capacities, favourable conditions for innovation, the demands raised by society itself, and by the regional and global environment (Tomaél et al., 2005).

The agrofood innovation system approach considers the interrelationships between all actors, public and private, in the creation, diffusion, adaptation and use of knowledge and innovations in all links of the value chain, as well as for the creation of a favourable environment for innovation. It also recognises the importance of both technological and institutional, social, organisational and commercial innovations. The role of the market for consumers as a driver of innovation and as criteria for its success places particular emphasis on the role of policies that promote innovation (ETP 'Food for Life', 2016). This also applies to traditional food products, despite the apparent controversy between innovation and tradition and the challenges that this controversy involves [e.g. Jordana (2000), Cagri Mehmetoglu (2018)]. According to Guerrero et al. (2009), a traditional food product is "a product frequently consumed or associated with specific celebrations and/or seasons, normally transmitted from one generation to another, made accurately in a specific way according to the gastronomic heritage, with little or no processing/manipulation, distinguished and known because of its sensory properties and associated to a certain local area, region or country."

In this way, innovation in the traditional food sector makes it possible to strengthen and expand the market of traditional food products according to societal challenges. For example, making the agrofood sector sustainable and competitive may allow safer and healthier diets, safe food, healthy and high quality, informed consumer choice, dietary solutions and innovations and methods that use fewer resources and additives and with fewer by-products and pollutants (Horizon 2020 Advisory Group, 2016). The most frequent innovation applied to traditional foods is based on product innovation, namely in packaging, product composition, size and shape or new ways of using the product. Other less common innovations refer, for example, to process innovations as they impact the identity and authenticity of the product and its production process. In the case of organisational or market innovation, despite having valuable potential, it is not

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perceived or recognised by all stakeholders in the traditional food sector chain (Gellynck & Kühne, 2008). CEOs and business owners are primarily responsible for innovation strategies in the food sector, with other internal stakeholders (employees) or even external stakeholders having minimal participation (Capitanio et al., 2009). These innovation strategies end up focusing on innovation for competition, encouraging the development of new products, with a mindset oriented towards the potential markets to be reached in the future and the use of territorial specialities, which in general are characteristic of large companies (Ardito et al., 2015). Since the majority of companies in the agrofood sector are small and medium-sized enterprises (ETP 'Food for Life', 2016), these strategies indicate a high level of innovation. It seems that the entrepreneurial vision overcomes the limitations of the innovation capacity of a small company, highlighting the importance of creating new products to keep satisfy existing consumers, and attracting new customers, focusing on the use of local material for manufacturing (Dadura & Lee, 2011).

The transition from an industrial society to one based on knowledge and information has brought significant changes to the social and organisational environment. We live a moment mixed with opportunities and great challenges, with rules and styles that directly and indirectly reflect the way of life of people and organisational systems (Pereira et al., 2009). Contradictions, inconsistencies, dualities and oppositions are part of the daily life of companies, with successful ones being those who take advantage of them as a competitive advantage (Scharf, 2007).

Knowledge can be classified into tacit (Polanyi, 1966), the one held by the individual and stemming from personal experience, and explicit, which can be articulated, coded, stored and shared. These two types of knowledge are in constant interaction, following a spiral composed of four forms of sharing: Socialisation, Externalisation, Combination and Internalisation, therefore called the SECI process. The transformation and creation of knowledge occur through the interaction between the various modes of conversion, in a continuous flow of knowledge creation (Nonaka & Takeuchi, 2008). The term "knowledge management" can be conceptualised as the review of the main processes, policies, and managerial and technological tools in light of a better understanding of the process of generation and creation, identification, storage, dissemination, sharing and use of organisational knowledge to generate financial results for a company (Terra, 2001). The author adds that knowledge management is not a project, but the centralisation of management processes in the knowledge variable. From this view, it is suggested that knowledge management is a practice that becomes cyclical, that starts with creation, goes through the steps listed above, and reaches the final use or application. In general, it is associated with incremental or radical innovations in products and services.

Knowledge management allows the exchange of information between stakeholders, fostering innovation and cooperation within companies (Hamdoun et al., 2018). It should also be noted that the management of information flows creates beneficial changes in the knowledge management of organisations, allowing the sharing of information with different sectors and groups of employees, improving their strategy (Nisar et al., 2019).

Thus, three research questions arise in this context:

1. Which social networks/digital platforms could be used in the Portuguese traditional food products sector to engage stakeholders?
2. How can social networks/digital platforms contribute to innovation in Portuguese traditional food products?
3. How can knowledge management be done in the context of Portuguese traditional food products?

This paper aims to answer these questions through a case study, identifying and describing the social networks and other digital platforms used in NEWFOOD project to actively disseminate knowledge, skills and resources to involved entities, including stakeholders from the relevant economic sectors, especially in the Portuguese traditional food products sector.

2. Materials and Methods

2.1. Type of study and case selection

This research follows the NEWFOOD project along with an entrepreneurship contest based on the innovation and valorisation of traditional food products implemented in a research university in Portugal,

using a unique case study method. According to Yin (2001), the purpose of the case study is to explore, describe or explain something. The author states a case study is the most commonly used strategy when the researcher has little control over real knowledge or even when it is non-existent and intends to know the "how" and the "why". The case study represents a suitable research method, mainly because it is based on intense and in-depth research of a particular object of study. Thus, studying a single case has the advantage of being able to describe in detail the described phenomenon (Eisenhardt & Graebner, 2007) to broaden the understanding of a complex issue, in addition to adding consistency to existing research (Merriam, 1998).

In this study, we present the case of an agrofood entrepreneurship contest at a research university in the north of Portugal to contribute and better understand innovation-based technologies, which can also have implications in other industrial environments. The article describes the merits and challenges of the dissemination of innovation and knowledge management through digital platforms involving stakeholders in the agrofood area. It should be noted that the objective of the present study is not to generate statistical generalisation, but to achieve analytical generalisation (Yin, 2001), and so compare the results of a case study to a previously developed theory (Eisenhardt & Graebner, 2007). For this reason, although the results of our research are not necessarily generalisable, they can be transferable insofar as they can be applied or made relevant in another context (Shenton, 2004).

2.2. Case study

2.2.1. The NEWFOOD project

NEWFOOD — Food Technologies Valorization project joined the ambitions of four public universities of the North Region (University of Trás-os-Montes and Alto Douro, Portuguese Catholic University Porto Regional Center, University of Minho and University of Porto) and was designed to accelerate the processes of expansion and consolidation of the so-called "traditional products" through a proposal of innovation catalysed by the transfer of knowledge and technology. NEWFOOD responds to the clear identification of "traditional" products, evolution, and adaptation of these products to modern markets as a priority for the development of the economy in the North Region. NEWFOOD uses the Regional Intelligent Specialization plan — RIS3 (CCDRN, 2014) merging agricultural and agrofood competences and resources held in the region, articulated through the four universities. There are very strong, productive and structured cooperation links of varied forms between relevant actors in the agrofood sector and the universities involved. These links include bilateral relations between companies and researchers, formal protocols, and associations formed specifically to advance the Research and Development agenda for the sector.

This project proposes three Actions that are articulated (Table 1): (1) develop a knowledge and skills map of the Region and an inventory of the needs of the sector to ensure the innovation process focused on the central axes of expansion and consolidation of the sector; (2) promote innovation projects aimed at generating new products/solutions of economic relevance in the "Traditional Products" sector and (3) actively disseminate knowledge, skills and resources to the entities involved, including stakeholders from the relevant economic sectors.

The NEWFOOD and Food Valorization Program and Contest that we refer to in this paper are organised by the Faculty of Biotechnology of the Portuguese Catholic University and took place between 2017 and 2020 – Figure 1. The NEWFOOD and Food Valorization Program and Contest had 4 phases: Admission, Development of Innovation Plans, Presentation of Products and Services in Media and Public Events, and Attribution of NEWFOOD and Food Valorization Awards, based on the following general criteria applied to the final proposals submitted to the Contest: consistency of proposals, depth of developments, correctness, application potential, innovation in the respective market, involvement of promoters and public utility.

2.3. Collection and analysis of information

The purpose of data collection is to obtain a set of information that addresses the research questions defined and captures the contextual complexity of the topic under study (Tuli, 2010). Thus, the present study collected primary data through documents developed for the NEWFOOD project, social networks and dig-

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Table1. Action and description of Newfood Project.

Action	Description
1- Knowledge and Needs	Mapping existing knowledge and the needs of the economic fabric in order to promote opportunities through the correspondence between knowledge - needs, generating added value. Two characterization studies will be carried out by each University, of the knowledge produced and existing, with potential for transference to the Stakeholders of the value chain. There will also be eight studies on Sector Needs conditioned by trends relevant to the value chain, supported by technical visits and participation in international events relevant to the intended dynamics. A set of Seminars / Workshops will ensure the Public Disclosure and discussion in the territory of the results of the studies carried out, including International Benchmarking with territories with dynamics in the area. The formation of the correspondence between Knowledge and Needs will be characterized in the Knowledge-Needs Matching Study with the respective public presentation to the target audience.
2 - Program for the Promotion of Innovation Projects	Valuation of knowledge through its application in the development of projects oriented to the innovation and competitiveness of "Traditional Food Products" based on the differentiation of endogenous resources to the territory, with results along the value chain (primary production, processing, ingredients, industry, packaging, distribution and food service). The intention is to promote two approaches, one, the "Food Valorization" competition, based on the support of proposals for innovative projects involving Proofs of Concept and Business Projects for Entrepreneurship - oriented to new business initiatives in the value chain; another, the "NewFood" competition, based on support for a selection of innovation proposals with projects of economic relevance and with added value for Prototyping. The projects and their results will be presented publicly at the Fine Showcase and Food Festival sessions, seeking to create conditions for stakeholder evaluation and promotion of knowledge transfer in the sector.
3 - Promotion of Knowledge and Innovation	Promotion of the transfer of knowledge to the economic fabric, extended to the whole value chain, through practical and demonstrative actions as well as through concrete projects with companies, of innovation for the availability of the capacities and resources existing in the Research Centers. Promotion of applied knowledge and innovation potential in the area to the national business community, the national and international consumer, and the technical and scientific community through a set of actions that include videos, campaigns on social networks, communications and publications of different nature at the level National and international.

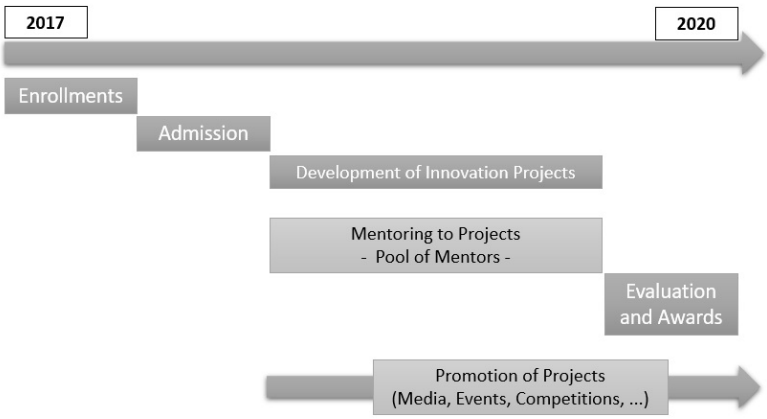

Figure 1. Calendar and phases of the NEWFOOD and Food Valorisation Program and Contest.

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ital platforms, and observations of some project actions.

Knowledge management was developed in the environment of business organisations, and its research and applications are focused on the perspective of organisational knowledge. However, there are other contexts in which knowledge management can be studied, such as, for example, the academic context, focused on the perspective of scientific knowledge. The benefits from efficient management of this knowledge, not only add value to the institution itself but to society as a whole, also leading to a quality of the services offered (Garcia & Valentin, 2009).

In this sense, Leite and Costa (2007) propose a conceptual model of scientific knowledge management, which consists of five processes used in this study:

• Identification: refers to the process of mapping the knowledge of the academic community (knowledge internal to the institution) in its tacit and explicit aspect and also to the mapping of knowledge external to the institution from scientific communities. Thus, the objective of knowledge mapping in the academic environment is to answer those who research what and where;
• Acquisition: is related to the process of acquiring internal and external knowledge that is necessary to provide the creation and maintenance of scientific knowledge and skills of the academic community.
• Storage/organisation: process related to the organisation and storage of explicit scientific knowledge in order to make it easily recoverable.
• Sharing: a process that has as its basic and fundamental assumption for the transformation of information and isolated experiences into something that the entire organisation can use.
• Creation: the process is one of the essential elements of knowledge management. It is related to the creation of new skills, competences and knowledge in the institution. In the academic context, the creation of new scientific knowledge occurs through scientific research.

However, it is counterproductive to mention processes such as the creation and sharing of scientific knowledge (phases of scientific knowledge management) without necessarily considering the communication that contributes and makes such processes viable (Leite, 2007).

3. Results

To meet the objectives under study, the social networks used by NEWFOOD were analysed. These included the Web platform and YouTube page, along with the Facebook, Twitter and Instagram accounts of the Faculty of Biotechnology – Portuguese Catholic University. Besides, other digital platforms were analysed: NEWFOOD website, Innovation platform, and Google photos (Table 2).

The promotion of the NEWFOOD and Food Valorization Program and Contest through social networks allowed 15 teams to be brought together with a total of 40 participants (mostly females), including PhD students, researchers, and other stakeholders of the Portuguese traditional food products sector. The teams developed 15 products to meet the sector's needs raised previously, adding innovation based on the research results of the associated laboratory. The project teams were supported, in this phase, by a pool of scientific and business mentors. It allowed the teams to get a more industrial perspective and a closer market drive to improve the potential for transferring their products and services to the market. Some examples of these products are cheeses with probiotics or with differentiated processing that allowed to improve its food safety, traditional sweets with functional bioactive compounds, application of new technologies applied to non-dairy drinks acorn based, use of bioactive substances as a way improve food safety in fermented meat products, among others. Additionally, dissemination materials were developed. Flyers, posters, and videos about the team's products were prepared and disseminated through the NEWFOOD website and Facebook page, as well as the innovation platform. Based on the evaluation of a panel of judges, 2 NEWFOOD Awards and 4 Food Valorisation Awards were awarded a value of € 2000 each. Participation in these competitions allowed the teams to exhibit the products developed to scientific and business stakeholders in national and international events.

According to the conceptual model of knowledge management (Leite & Costa, 2007) — Table 3, we found that the Innovation Platform, Google Photos,

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Table 2. Social networks/ platforms used by NEWFOOD (31-01-2020).

Social network/ digital platform	Followers/ subscribers	URL
Newfood		
Facebook	195	https://www.facebook.com/newfood.esbucp/
Youtube	10	https://www.youtube.com/channel/UC4Az6gVP-eKLHGClaN9gdWQ/
Website	Not applicable	http://www.esb.ucp.pt/pt/newfood
Google photos	Not applicable	https://photos.google.com/share/AF1QipO4YjhOT__ k9MSAtnpqRnOx1o_WTNHpBY8SFCvF6L7RlmO 2hTm1HJVJdRfL5hRRxA?key=REdJazZ3ZFNDelB ZbUw5alBibi1HYWt6WlZsVjZB
Faculty of Biotechnology – Portuguese Catholic University		
Facebook	5627	https://www.facebook.com/catolicaportobiotecnologia/
Instagram	956	https://www.instagram.com/catolica.porto.biotecnologia/?hl=pt
Twitter	123	https://twitter.com/BiotecCatolica
Innovation platform	Not applicable	http://inovacao.esb.ucp.pt/
Knowledge Portfolio	Not applicable	http://www.cbqf.esb.ucp.pt/en/cbqf-projects?c=16002&l=en&o=datedesc&s=

YouTube and the NEWFOOD website were used as information storage platforms that could be disseminated through the social networks used by the project, fitting in the storage and organisation process of the conceptual model. On the other hand, the social networks themselves (Facebook, Instagram and Twitter) served as platforms for storing photos and videos of the project, but also played a pivotal role in the dissemination of knowledge, being part of the sharing process of the conceptual model of knowledge management.

4. Discussion

The objective of this study was to answer the following questions: which social networks/digital platforms could be used in the Portuguese traditional food products sector to engage stakeholders; how can social networks/digital platforms contribute to innovation in Portuguese traditional food products; and, how can knowledge management be done in the context of Portuguese traditional food products? To answer the questions, the NEWFOOD Project was analysed through a case study in the sector of Portuguese traditional food products. A survey was made of the social networks and digital platforms used by the NEWFOOD project to disseminate knowledge regarding Portuguese traditional food products. These platforms were used to launch an innovation program and contest to bring together different stakeholders in the Portuguese traditional food sector. Finally, the knowledge management process focused on the promotion of Portuguese traditional food products by the NEWFOOD project was described.

Analysing the data collected on the social networks used by NEWFOOD (Twitter, Facebook, Instagram and YouTube) it is possible to state, based on the studies of Nonaka and Takeuchi (2008), that explicit knowledge is predominant. It is characterised by objectivity and rationality, being a sequential and digital knowledge. The interaction between explicit knowledge is a form of knowledge creation identified in these social networks, an idea corroborated by Choo (2003), who highlights that the processes of information conversion, in which the combination would result, through

Table 3. A conceptual model of scientific knowledge management (Leite & Costa, 2007) for NEWFOOD.

Process	Description
Identification	Thought the innovation Platform and Knowledge Portfolio of the Center of Biotechnology and Fine Chemistry / Faculty of Biotechnology of Portuguese Catholic University we mapping the knowledge of the academic community - knowledge internal to the institution - in its tacit and explicit aspect. We also mapping of knowledge external to the institution from scientific communities by studies conducted in NEWFOOD's Action 1.
Acquisition	On Action 2 of NEWFOOD we promote a team building that brought together 15 teams of PhD students, researchers and stakeholders that applied to the NewFood contest and program supporting Knowledge and Technology Transfer to the Portuguese traditional food sector. The team attended meet with business mentors to provide the creation and maintenance of scientific knowledge and skills of the academic community on business issues.
Storage/ organization	Developed materials were Stored/ organized. Videos on Facebook and Youtube, photos on Facebook, Instagram, Google Photos. Other informative materials with text on innovation Platform and Knowledge Portfolio websites.
Sharing	The sharing process was accomplished by social networks (Facebook, Instagram, Twitter, Youtube) and digital platforms (innovation Platform and Knowledge Portfolio, Google Photos, website).
Creation	We support 15 PhD students and researchers teams to develop new products in the field of traditional foods. These teams develop business projects, communications plans and prototypes exposing the to business tissue. Until know, it allowed the beginning of the patenting of 4 technologies associated with the developments, different technical publications, and range of business contacts for trials.

the interaction of explicit knowledge, in the generation of new ones. This possibility was observed on the networks through the posting of information and the ability to post comments. Davenport and Prusak (2003) state that for knowledge to be transmitted it needs to be presented; on social networks, this is done through text publications, images and videos, using a channel that allows the encoding of that knowledge and its storage in a virtual way. Although the authors claim that knowledge needs to be absorbed and used in order to contemplate its transfer process, Choo (2003) argues that this process is linked to the processing of information. Therefore it can be recognised in the social networks used by NEWFOOD.

Linked to the presentation of the content, Davenport and Prusak (2003) cite that knowledge must be coded to be shared, meaning it should be adapted to a common language that the interlocutor can easily understand. The publications made by NEWFOOD social networks use the respective languages of each type of social network — short information on Twitter and Instagram and medium and long on the others. According to the authors, the codification of knowledge allows it to become permanent, and not only in the mind of those who transmitted it. The level of reach of the information published by NEWFOOD demonstrates the break of frontiers characteristic of the Knowledge Society, as previously exposed. It can be assumed that the contents have been viewed in countries other than Portugal by Portuguese speakers abroad, with common interests in national matters. Alternatively, for example, the content may have reached English speaking countries since some publications were translated into English to facilitate the sharing of knowledge with outside readers as it is the predominant language in various cultures. Visualisations of the content of the four social networks used by NEWFOOD demonstrate that there is an audience that is interested in publications. When evaluating the subjects of the posts, most of them are informative, often not allowing debate, discussion and exchange of information, as is the case with the post about agro-food issues. It is possible, therefore, that the type of content published is responsible for the low interaction between members of the network.

It was also found that the social networks and digi-

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tal platforms used by NEWFOOD were able to reach around 6000 (followers) stakeholders in the sector of Portuguese traditional food products. Ioanid et al. (2018) study on the impact of social networks on the innovation potential of small and medium-sized enterprises, found that interviewees consider that stimulating innovation through social networks helps to retain customers and win new customers, offer better product customisation and services that meet the needs of customers and enables entering the market with new innovative products, inspired by ideas posted on social networks. However, they emphasise that it is very difficult to quantify the innovative ideas gathered on social networks and other sources, such as private discussions with partners or suppliers.

The engagement of interested parties has been considered a key factor for innovation, as it allows to improve the company's capacity and innovation strategy (Iturrioz et al., 2015) through the generation of ideas, which allows identifying critical points at an early stage of the innovation process (Widén et al., 2014). The number of different stakeholders involved in the process depends on the nature of the innovation and can be decisive in the success of the innovation project (Barlow et al., 2006).

In the case of the NEWFOOD Project, the launch of the innovation program and contest, through social networks and digital platforms, allowed to bring together different stakeholders from the sector of traditional Portuguese food products, including PhD students, researchers, among others with skills in biotechnology, food engineering, and nutrition sciences. A total of 15 teams participated in the innovation program and contest, in which they added innovations to 15 traditional Portuguese food products, essentially product and process innovations. The teams were supported by scientific and business mentors who helped make the innovation plans more realistic and adjusted to the needs of the market. Thus, demonstrating that social networks and digital platforms can bring together different stakeholders to promote innovation in Portuguese traditional food products.

It has been reported that the networks created in entrepreneurship programs led to the sharing of knowledge, experiences and resources, thereby generating greater interest among the involvement of and interaction between stakeholders (Galvão et al., 2020). Besides, the involvement of academic stakeholders in the innovation process allows adding human capital, consisting of a wide variety of scientific knowledge, experience and knowledge of laboratory techniques, for the development of a scientific strategy. As well as social capital, essential for innovation management and the development of entrepreneurship, since scientific knowledge can be transported to scientific networks that incorporate the knowledge generated in the scientific community, creating the basis for the development of relationships between entrepreneurs, company and members of their social networks (Murray, 2004).

To think about how to manage knowledge for the promotion of the sector of Portuguese traditional food products it is essential to outline innovation strategies and attract stakeholders and create synergies for the development of companies in the sector. In the case of Portuguese traditional food products, taking the NEWFOOD project as an example, the conceptual model of knowledge management (Leite & Costa, 2007) was described, which included five processes: identification, acquisition, storage/organisation, sharing, and creation. The first three processes of knowledge management were described above, namely through the description of the social networks/digital platforms used by the NEWFOOD project, as well as by its innovation program and contest.

In general, results show that knowledge management practices could contribute to innovation, directly and indirectly, as in the study of Ode and Ayavoo (2020). Knowledge sharing indirectly contributes to innovation through the application of knowledge. The application of knowledge, through the creation of knowledge, makes it more active and relevant to the creation of value (Choi et al., 2010). Also, the application of knowledge responds to the different types of knowledge available in an organisation and assists in the use of knowledge that has been created and shared (Shujahat et al., 2018), in the case of the NEWFOOD project we contribute directly to innovation through the creation of knowledge in Portuguese traditional food products, with the innovation program and contest.
In fact, according to Pantano and others (2019), the involvement of external stakeholders such as universities can help to establish a balance between business

innovation and the resources available in the market and technology. Stakeholder engagement could help penetrate existing markets with new products in terms of developing innovations to satisfy new segments; as well as exploring new markets with the development of incremental innovations.

This study has some limitations and opportunities that should be noted. Firstly, some of the results of this study are extracted from direct observation. Moreover, the fact that it is a case study does not allow the extrapolation of the results to other situations. The approach used in this study is transversal and does not reflect the performance of the mechanisms examined in this research in the long term. The knowledge management practices are multidimensional, and, in this study, we focused on only five knowledge management processes: identification, acquisition, storage/organisation, sharing, and creation. Other dimensions of knowledge management have not been examined and can be equally useful to explain innovation in the traditional food products sector. As a suggestion for future research, the effect of other knowledge management and innovation practices in different sectors can be examined using quantitative methodologies, and it can also adopt a longitudinal approach examining the long-term effect of these practices. Despite these limitations, this study provides practical empirical evidence to promote and link knowledge management and innovation in the traditional food sector.

5. Conclusions

Business innovation is the result of a company's efforts to develop and place on the market new business models, processes, products or services, with added value recognised by customers. Given the unpredictable and increasingly accelerated competitive environment, companies are challenged to identify new ways to create value and explore market opportunities. Social networks have accelerated some of these processes, revealing a simple and easy way to connect people anywhere in the world and allow interaction on different subjects between members of those networks. Accounts were created on social networks or other digital platforms to achieve the objective of actively disseminating knowledge, capabilities and resources to the entities involved, including stakeholders in the sector of Portuguese traditional food products. Besides, during the NEWFOOD initiative, several materials for the dissemination and promotion of Portuguese traditional food products were developed. It verified that disseminated information and knowledge, as well the launch of the innovation program and contest, contributed to the promotion of technological innovation involving the generation of new ideas for products and services, and the alignment between stakeholders.

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Conflict of interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Small-scale milk production systems in Colombia: a regional analysis of a potential strategy for providing food security

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Colombia has an agro-ecological diversity that favours the implementation of milk production systems. Dairy farming is an integral part of the rural economy and makes a positive contribution to the nutrition and income of families. The objective of this study was to classify milk production systems in the community of El Peñon (Municipality of Sibate, Colombia), and analyse the results in connection to the concept of food security. The study evaluated components related to production levels and administration using variables such as (i) location, biophysical aspects, use and management of land (ii) forage resources and feed (iii) animal resources (iv) animal reproduction and health (v) milk production and marketing, and business management (vi) labour, infrastructure and equipment and (g) owner information. Eighteen dairy farms located in the study area were analysed and thereby classified using multiple correspondence analysis and descriptive study. The information was obtained from the milk production systems using a questionnaire. The analysis of conglomerates allowed us to identify heterogeneous production models due to their diverse production conditions and the different sizes of productive units. Milk producers were typified in 4 groups as specialised dairy (33%), semi-specialised dairy (17%), small-scale dairy (28%), and family-owned dairy farms (22%). The dairy systems represent a productive potential to support food security, especially small-scale systems. For this reason, it is important to implement efficient technological models in small-scale dairy systems to contribute to the improvement of food security for the population.

1. Introduction

Food is one of the basic needs of human beings, and according to the FAO, the size of the global population and its accelerated growth is the biggest problem and the most serious threat to humanity (FAO 2002; 2014; 2019a). One of the current problems of the worldwide population is malnutrition due to a lack of nutrients, protein, and micronutrients to meet the basic needs to maintain normal functions, growth, and development (Latham, 2002; Pinstrup-Andersen, 2009). Malnutrition promotes the development of diseases and undesirable physical conditions (FAO, 2009a; Weiler et al., 2015). FAO reports for the years 2015 and 2016 the prevalence of malnutrition in the world, and the values are 794 (10.8%) and 815 (11.0%) million people, respectively. These figures show an increase in the number of undernourished and hungry people, prin-

cipally a result of the following causes: natural disasters, armed conflicts, population growth, and poverty (FAO, 2009b).

It is estimated that the growth of the population could soon overtake food production and supply (Burchi & De Muro, 2016). This estimate is mainly due to an increase in the population of urban areas due to high fertility rates, migration from rural areas to cities, and inequality in the distribution of food, which is gradually affecting a global financial crisis. In this regard, studies have been conducted at a global level for the development of policies that would help mitigate the dynamics of poverty and solve the problems connected to the challenge of hunger (Borch & Kjærnes, 2016; Gohar & Cashman, 2016; Myers & Caruso, 2016; Martin et al., 2016; Lipton & Saghai, 2017; Moragues-Faus, 2017; Leventon & Laudan, 2017). According to FAO (2002), milk is considered one of the most nutritious food types, because it provides proteins, carbohydrates, fat, minerals, and vitamins of high biological value.

Based on the previous considerations, agricultural producers have the challenge of increasing productivity to meet the needs of the population. Livestock plays an important role in the livelihoods of millions of milk producers in developing countries. Livestock farming provides approximately 26% of protein and 13% of the total calories consumed by people (FIDA, 2016). The dairy sector has been recognised for its leadership role in sustainable practices for several years. In 2019, world milk production was 852 Mt (OECD-FAO, 2020). The expansion of production originates mainly from India, Pakistan, China, the European Union and Brazil and on a smaller scale in countries such as Australia, Colombia and Argentina (FAO, 2019b). Colombia reported total production of 7,301 million litres of milk for 2019 (FEDEGAN, 2020).

In the livestock sector, it has been determined that Colombian cattle production is made up of a variety of production models within a heterogeneity of systems, mainly of dairy cattle. Authors have classified worldwide milk production systems and contributions to food security in several ways: as tropical or dual-purpose cattle, intensive dairy, and small-scale dairy (García et al., 2012; Castillo et al., 2012; Hernández et al., 2013); specialised dairy systems located in high or low altitudes and dual-purpose cattle (González, 2012; Vargas-Leitón et al., 2013); and specialised dairy, semi-specialised dairy, family-owned dairy farms and dual-purpose cattle (Cortez-Arriola et al., 2015). According to FEDEGAN (2017), the figure for milk production in Colombia is reported to be 7,094 million litres per year, obtained from different production systems. These figures have been increasing over the last few years with a total of 7,257 and 7,301 million litres in the years 2018 and 2019, respectively (FEDEGAN, 2019). Therefore, the objective of this study was to carry out the classification and analysis of milk production systems in El Peñon.

2. Materials and Methods

2.1. Study area

The study was conducted with milk producers in the farming area El Peñon (Municipality of Sibate, Cundinamarca, Colombia), geographically located at coordinates 4° 30'12 "N and 74° 20'47W, at 2,767 metres above sea level (Figure 1). A cold climate, an average temperature of 13.5 ° C, and a rainfall of 723 mm characterise the region. The region's economy is predominantly built on agriculture, and for this reason, it was chosen for the study.

2.2. Data collection

This study was carried out between November 2018 and July 2019. Information regarding the producers and milk production systems was collected through a series of both semi-structured and open interviews using the survey method. For the survey, the study region was selected given the high heterogeneity and variability of the farming and livestock production systems, to provide adequate representation of the technical, socioeconomic, and biophysical diversity of the region. The selection of respondents was made through non-probabilistic snowball sampling, where the sample of producers obtained corresponded to the entire population under study.

The participants were active milk producers, and the focus group was comprised of 18 producers, which is the total population of producers in the studied region. The study evaluated components related to the product levels and administration of these systems using variables such as (i) location, biophysical aspects, use and management of land (ii) forage resources and

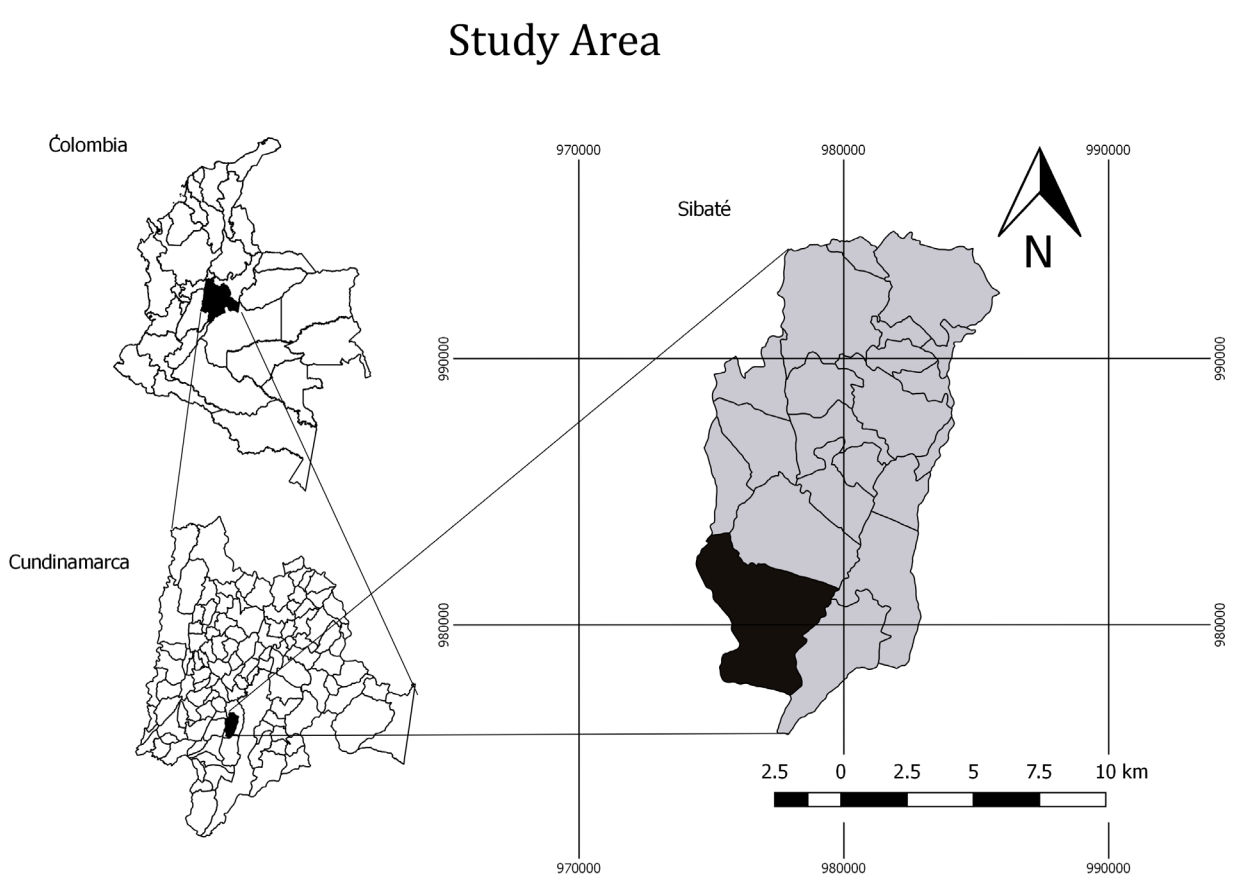

Figure 1. Study area: Map of El Peñon, highlighted. Cundinamarca State, Colombia.

food (iii) animal resources (iv) animal reproduction and health (v) production of milk, marketing, and business management (vi) labour, infrastructure and equipment and (g) owner information.

2.3. Statistical analysis

The analysis of the data collected was carried out through the evaluation of quantitative and qualitative variables, through multiple correspondence analysis (MCA) and descriptive studies using the statistical package SAS (Statistical analysis system, version 9.4).

3. Results

The information obtained in this study allowed the identification of different types of milk production systems according to structural, technical, and production characteristics.
Figure 2 shows the results of the cluster analysis of milk producers. Results were classified into four groups of milk production systems, according to the similarities of the variables. The groups identified were classified as specialised dairy (33%), semi-specialised dairy (17%), small-scale dairy (28%), and family-owned dairy farms (22%). It was evidenced that dairy cattle and milk production is one of the traditional trades for the majority of families living in the region studied. Half of the current production systems correspond to small producers, which represent productive potential and food security.

There are diverse dairy production systems in the study region that incorporate different technological models for obtaining dairy products. One of the main components of these systems is the introduction of different breeds. However, the Holstein breed is used at a proportionately high level due to its productivity and adaptability to existing environmental conditions. Pastoral systems dominate dairy production in the study region. All production systems also presented a similar proportion of grassland established with improved pastures (80%). The Pennisetum clandestinum was more common in dairy systems.

The diversity found among the systems reflects the implementation of productive models with different levels of several factors, such as the use of technology,

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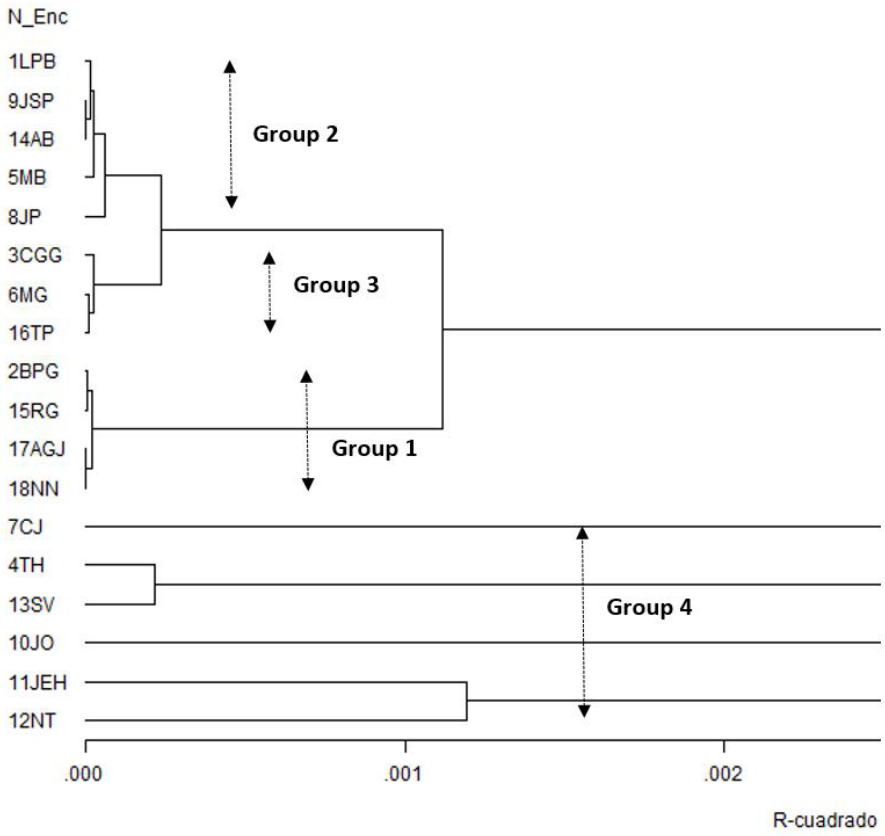

Figure 2. Dendrogram of milk production system conglomerates in El Peñon. Arrows indicate the grouping of dairy farmers classified. Group 1. Family-owned dairy farms Group 2. Small-scale dairy Group 3. Semi-specialised dairy Group 4. Specialised dairy

inclusion of productive strategies related to the management of forage resources, supplements and food by-products, use of animal resources of high genetics, infrastructure, and manpower. It should be noted that these cattle production systems are developed in different micro-ecosystems with different degrees of intensification of variables and heterogeneous socioeconomic strata.

Table 1 shows the average values of the production parameters for milk production systems in the region of study.

Family-owned dairy farms (Group 1) correspond to 22% of the studied populations and are characterised by having on average less land (1.8 + 1.1 ha) and fewer animals (3.5 + 2.7). The lack of productive technology use characterises these systems and the mean values of milk production/cow/day and total are 6.7 + 2.8 and 8 + 6.8 litres, respectively. In terms of applying labour to livestock development, work is mainly limited to the owner and their spouse. This study reveals that milk producers in these systems are among the least educated people in the region, and this can be a problem when it comes to incorporating new technologies. In regards to small-scale dairy (Group 2), which corresponds to 28% of the population, it was found that the characteristics of the production model analysed were similar to those of Group 1. However, it reported higher values for land size (14 + 3.2 ha), number of animals (17.9 + 4.3), milk production/cow/day (10 + 3.1 litres) and milk production/day (82 + 7.9 litres). Another key characteristic of family-owned dairy farms and small-scale dairy groups is the lack of technical assistance, access to extension services, and the high costs of inputs.

On the other hand, semi-specialised dairy systems (Group 3) correspond to only 17% and are characterised by the inclusion of production technologies that focus on improving nutritional and genetic components. These production technologies are done by pro-

viding supplements to animals, and crossing breeds with high genetic value. These systems have more land (22.4 + 6.1 ha) which holds a larger number of animals (28.3 + 5.5) with higher levels of milk production/cow per day (13.3 + 3.2 litres).

Regarding the characteristics of Group 4, specialised dairy systems correspond to 33% and have the most land (118.4 + 60.4 ha) and the largest number of animals (124.7 + 29.6). This typology reports the highest level of milk production/cow per day compared with the other systems, as well as the higher insertion of labour to carry out activities related to production. Furthermore, they employ the most productive strategies, including rotational grazing systems with improved foraged grasses and alternative animal supplementation. Besides, this group also works to improve nutritional, genetic, and sanitary components. To this end, the group uses soil fertilisation practices to increase biomass production, as well as reproductive biotechnologies like artificial insemination using animals with high-value genetics. They also use biosecurity and vaccination plans.

Another factor is that while small-scale dairy system producers only have access to information via radio and television, semi-specialised and specialised dairy producers used mobile phones to obtain up-to-date information and access professional technical support.

Table 1. Parameters of milk production systems in the area of El Peñon.

	Productive system			
Parameter	**Group 1**	**Group 2**	**Group 3**	**Group 4**
	Family-owned dairy farms	**Small-scale dairy**	**Semi-specialised dairy**	**Specialised dairy**
Number of dairy farmers	4	5	3	6
% of the sample	22	28	17	33
Farm size (ha)*	1.8 ± 1.1	14 ± 3.2	22.4 ± 6.1	118.4 ± 60.4
Animals				
Numbers of animals *	3.5 ± 2.7	17.9 ± 4.3	28.3 ± 5.5	124.7 ± 29.6
Production cows *	1.2 ± 0.9	8.2 ± 2.7	13.6 ± 2.1	61.9 ± 12.5
Dry cows *	0.8 ± 1.1	2.9 ± 1.3	4.6 ± 1.2	20.2 ± 7.9
Heifers *	0.6 ± 0.9	2.8 ± 0.7	4.5 ± 1.1	26.1 ± 7.7
Calves *	0.7 ± 0.3	3.4 ± 0.6	4.7 ± 0.9	15.1 ± 3.9
Bulls*	0.3 ± 0.5	0.4 ± 0.5	0.6 ± 1.1	1.6 ± 1.3
Production				
Milk production/cow/day (litres)*	6.7 ± 2.8	10 ± 3.1	13.3 ± 3.2	16.5 ± 3.7
Milk production/day (litres)*	8 ± 6.8	82 ± 7.9	180.9 ± 6.6	1021.4 ± 83.2
Labour				
Owner	1	1	0.6	0.3
Spouse	0.2	0.2	0.1	0.2
Administrator	0	0	0.2	0.7
Milking staff	0	0	1	3
Day labourers	0	0	1	1.8
Commercialisation				
Self-consumption (litres)*	1.5 ± 0.5	3 ± 1.4	2.6 ± 0.6	9.8 ± 1.7
Sale (litres)*	6.5 ± 2.2	79 ± 6.4	178.3 ± 5.9	1011.6 ± 30.1

(%) Percentage of dairy farmers that belong to the milk production system.
* Values represented in average ± standard deviation

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4. Discussion

Milk production systems are concentrated around the main cities and municipalities where the demand for milk is highest. Farms in the region were grouped based on multivariate analysis, taking the production system into account, to identify them according to their use of technology.

In general, all the systems studied performed milking twice a day and marketed their milk locally. As described above, milk production systems have a high degree of variability in their productive indicators, given the number of technologies that could directly affect the productivity, profitability, and competitiveness. Therefore, the productivity of these systems has an indirect relationship with the size of the herd and the technological model implemented. According to Holmann et al. (2003), the improvement of competitiveness is associated with the size of the herd.

The diversity within the different systems is due to technological and economic factors and organisational issues that have allowed the adoption of uneven technological innovations within dairy systems, resulting in different levels of productivity and profitability (Sraïri & Lyoubi, 2003; Köbrich et al., 2003; Gaspar et al., 2007; Giorgis et al., 2011; García et al., 2012; Gelasakis et al., 2012; Nivia et al., 2018).

On the other hand, dairy farming is a basic part of the rural economy. This study has shown that as milk producers have made technological changes and investments, their competitiveness and productivity have improved, and this has increased net income per hectare. Thus, the specialised dairy producers report the highest values in the production of milk/cow per day. Dairy farming is a highly labour-intensive industry, and small-scale dairy and family-owned dairy farms rely greatly on family labour.

Furthermore, the typification of milk production systems showed that half of the systems are distributed between family-owned dairy farms and small-scale dairy. These categories contribute significantly to the total milk production in the region. For this reason, small-scale dairy producers can contribute a remarkable share to the total milk production of the country and can be a viable instrument to stimulate economic growth and reducing poverty (Bennett et al., 2006). A general analysis of milk production systems in Colombia has allowed us to identify which systems have begun to use technology to advance milk production, specifically in areas such as genetic improvement and food and nutrition programs. To a large extent, this explains the production growth during the past few years. However, the preceding is mainly due to specialised dairy systems, which have been able to deploy new technologies.

Despite these factors, the dairy industry in Colombia has shown a lack of profitability. One of the main problems in the milk production sector is the lack of technical assistance and the high costs of inputs. The limited access to extension services has been a limiting factor for the improvement of producer productivity and dairy product supply. Therefore, the results showed that small-scale dairy system producers only have access to information via radio and television. In contrast, semi-specialised and specialised dairy producers used mobile phones to obtain up-to-date information and to access professional technical support. Small-scale production systems represent a productive potential in the region and therefore require the implementation of efficient technological models. This study has concluded that small milk production systems can contribute to high levels of food security by offering safe and nutritious products to the population. Moreover, a growing demand for livestock products over the next 20 years, which could more than double, are mainly related to factors such as urbanisation, economic growth and changing consumption patterns in developing countries. In this way, they can meet the population's dietary needs and food preferences for an active and healthy life, as described by the FAO (2002). This analysis supports the fact that the adoption of technology by family-owned dairy farms, small-scale dairy, and semi-specialised dairy (corresponding to 75% of the studied population) is essential to intensify milk production and thus ensure greater performance and productivity. Also, a market-oriented dairy enterprise approach is proposed as a strategy to increase the income of small producers (Bennett et al., 2006). On the other hand, small-scale livestock production is mainly based on family farms and is crucial for the livelihoods of the rural poor, food security and the creation of employment.

The dairy industry has experienced enormous changes over the last few decades due to the implementation of economic policies and the use of new technology. World milk production grew by 1.3% in 2019 to around 852 Mt of which 81% corresponds to cow's milk. This growth is attributed to increased production and not to herd growth. Strategies as performance growth drivers include optimising milk production systems, introducing better genetics, improving animal health, and improving efficiency in feeding (OECD-FAO, 2020).

Milk production in Colombia grew 2.3% in 2018, with a total of 7,257 million litres, of which only 47.06% were collected. In 2019, a total of 7,301 million litres of milk was produced, with a low increase of 0.6% compared to the previous year, related to the climatic factor, primarily due to the rainy seasons (FEDEGAN, 2020).

Milk production systems are mainly classified as specialised, dual-purpose, and small-scale, which contribute to the volume of national production in different proportions. However, small-scale dairy producers contribute a remarkable share to the total milk production of the country. Finally, the Colombian State must adapt technical assistance policies focused on this type of producer.
In general, the greatest global challenge facing cattle production systems is linked to changes in the availability of food for animals, both in terms of quantity and quality (specifically concerning protein levels). For this reason, from a development perspective, it is appropriate to adapt research areas. Studies should focus on milk production systems in rural areas that incorporate models of feeding intended to increase the availability and quality of forage, as well as the animal population per hectare (Tapasco et al., 2019).

The genotypes present in production systems are a constraint for productivity, particularly in rural areas based on small-scale. However, the genetic resources in the region studied reflect the considerable size of the population and the biodiversity that exists between them.

5. Conclusion

In conclusion, the proposed methodology identified four groups of milk production systems based on their productive and administrative characteristics, starting with the analysis of conglomerates. This diversity reflects the variability of the productive model, in keeping with the level of adoption and use of technology and the inclusion of productive strategies. This study identified that the perception of the milk producers of the new technologies was the main limitation to adopt new technologies. Biophysical, agronomic, and socioeconomic factors that affect milk producers are all attributed to the yield gap. The adoption of technology is affected by factors such as farm size, availability of capital and labour, education, and land ownership. Our findings showed that Small-scale and Family-owned dairy farms represent a productive potential for food security, given the number of existing producers and the ability to implement efficient technological models. Training is, therefore, essential to contribute to the decrease of the starving population and to achieve an effective impact on sustainable rural development in areas where milk production can be competitive.

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Conflict of Interests

The authors hereby declare that there is no conflict of interest. Besides, the funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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Research Paper

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Bacteriological quality and safety of four fluid dairy products sold in El Fayoum Governorate, Egypt

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The study was designed to assess the safety and bacteriological quality of 120 samples, including small-scale fluid cream, large-scale Laban rayeb, pasteurised milk, and ultra-high temperature milk (UHT). Thirty samples of each product were collected from different localities in El Fayoum province, Egypt. Samples were analysed for the total bacterial count (TBC), total coliforms, faecal coliforms, *Escherichia coli*, and Staphylococcus aureus. The mean value of TBC in small-scale fluid cream and pasteurised milk were $1.68\times10^{6} \pm 1.3\times10^{5}$ and $4.30\times10^{3} \pm 6.66\times10^{2}$ CFU / ml, respectively. The mean value of faecal coliforms in fluid cream was $1.87\times10^{4} \pm 8.18\times10^{3}$ CFU / ml. *E. coli* was only present in fluid cream with a mean value of $2.25\times10^{3} \pm 8.63\times10^{2}$ CFU / ml. Isolated *E. coli* strains were serologically identified as O125(16/30), O158 (10/30), O157 (4/30), with a percentage of 53.33, 33.33 and 13.33% respectively. Conventional polymerase chain reaction (PCR) identified the presence of *aroA* and *fimH* but not *Stx1* and *Stx2* genes. *S. aureus* was detected in the examined fluid cream samples, with a mean value of $7.56\times10^{4} \pm 8.81\times10^{3}$, CFU / ml. High microbial counts of TBC, *E. coli* and *S. aureus* in fluid cream may present a public health hazard to the consumers. Therefore, it is necessary to improve the quality of locally produced cream to diminish the hazard from that product.

1.Introduction

Safe and healthy foods are a mandatory requirement for the maintenance of vital functions. Food safety is a basic concern of both the food industry and consumers because of the dramatically increased number of foodborne diseases. The World Health Organization (WHO) stated that more than 100 million people living in the Eastern Mediterranean region, including countries in the Middle East and North Africa, become ill with a foodborne disease every year (World Health Organization, 2015). Food problems such as, inability to provide food safety are becoming gradually more complex because of the increase in food varieties in the world (Yoruk, 2018).

Milk contains many components that make it a highly nutritious food; equally, it provides a good environment for the growth of a wide variety of microbes. Bacteria can contaminate raw milk through colonisation of the teat canal or an infected udder, or by cross-contamination through the surface of the teats, by air, from manual or mechanical milking contact, water and milk contact surfaces, and storage and transport equipment (Baylis, 2009; Bytyqi et al., 2011).

As a result of the common Egyptian belief that raw milk has health benefits and high nutritional value, the consumption of raw milk is more common than heat-treated milk. However, the consumption of raw milk and its products, such as small-scale cream, have been linked to many forms of bacterial infection, including infection with *Brucella* spp., *S. aureus*, *Salmonella*, tuberculosis, as well as *Yersinia* and pathogenic *E. coli* food poisoning (Baylis, 2009).

Raw milk (or cream) is the basic material from which all dairy products are made. The quality and safety of the final product is greatly affected due to the diversity of microorganisms as well as the level of contamination in the raw materials. Reports outlined by the Centers for Disease Control and Prevention in the period from 1993 to 2006 indicated the risk of causing outbreaks and outbreak-associated illnesses by non-pasteurised milk and milk products exceeded that of pasteurised products by 150 times (Langer et al., 2012).

The current study included some of the dairy products available and circulated in the Egyptian market, including pasteurised milk, sterilised milk and unpasteurised cream. The study is unique in dealing with a product that is only available in the Egyptian market- Laban rayeb, which is a fermented milk made by Egyptian farmers. Fresh milk is placed in an earthenware pot "Matrad" or "Shalia" and left undisturbed in a warm place until the cream rises and the lower, partially skimmed milk coagulates. The layer of cream is removed and made into butter, while the remaining curd 'Laban rayeb' is either consumed as a pasteurised or unpasteurised fermented milk or is converted to a soft acid cheese known as Kareish (El-Gendy, 1983).

Escherichia coli and coliforms in food imply poor hygiene and sanitary practices (Ekici & Dumen, 2019). Their presence increased prevalence is typically due to factors, such as poor sanitation and lack of basic infrastructure like electricity and an adequate water supply (Martin et al., 2016).

E. coli live commensally in the gastrointestinal tract of most mammals, including humans, without causing disease. However, a small fraction of *E. coli* are human pathogens and have been implicated in foodborne illnesses with increasing frequency over the last two decades. Ingestion of enteropathogenic *E. coli* (EPEC) can result in a mild gastrointestinal disease that is relatively self-limiting. Still, a subset of pathogenic *E. coli*, enterohemorrhagic *E. coli* (EHEC), can cause hemolytic-uremic syndrome (HUS), a serious, potentially fatal illness. *E. coli* has been isolated from a number of food products, including meat, fruits, milk and milk products, which can act as a medium for foodborne disease transmission (Lee et al., 2009; Solomakos et al., 2009; Maffei et al., 2013). The most pathogenic strains are referred to as Shiga toxin-producing *E. coli* (STEC) including *E. coli* O157:H7. Bulk tank milk often contaminated with EHEC through cattle faeces which is considered the major reservoir of this pathogen. Therefore, raw milk poses a risk for STEC, and some outbreaks with dairy products have been recently reported (Dhanashekar et al., 2012; Van Asselt et al., 2017).

An important feature of the STEC group, implicated in many outbreaks, is its ability to resist acidic pH (close to pH of 2.5), which enables it to survive in foods with low pH values and genes that also enable the pathogen to attach to the gastrointestinal tract (Cutrim et al., 2016; Salim et al., 2017). *FimH* is a mannose-specific adhesion protein that is responsible for mediating bacterial attachment and invasive properties of *E. coli* (Chassaing et al., 2011).

S. aureus is an organism that causes foodborne intoxication, usually within four to six hours after eating food containing the enterotoxin (De-Buyser et al., 2001; Zeinhom et al., 2015). *S. aureus* enterotoxins are heat-resistant and not inactivated by the majority of ultra-high temperature (UHT) processes (David et al., 1996). *S. aureus* presence in food is an indicator of its contamination by people during the production and handling of dairy products or the direct shedding into milk from diseased animals.

The objective of this study was to assess the prevalence of some foodborne pathogens as an indicator for food safety and quality in the most popular Egyptian dairy foods, including unpasteurised cream, pasteurised Laban rayeb, pasteurised milk, and UHT milk, address pathogenicity factors and to determine the prevalence, serotypes and virulence genes of isolated *E. coli* strains.

2. Materials and Methods

2.1. Samples

A total of 120 samples, including unpasteurised cream, pasteurised Laban rayeb, pasteurised milk and UHT milk. Thirty samples of each product were collected randomly from different localities in El Fayoum province, Egypt, during the winter season. Unpasteurised cream samples (200 ml) were collected from three separation centres (containing 3 hand-operated separators) from farmer's containers and placed in sterile screw bottles. Other pasteurised samples of dairy products (500 ml each) were purchased in their retail packages from one producer, but with different lot number and from different local grocery stores over several months. Samples were taken to the laboratory in an insulated icebox (3–5°C) within 2 h of purchase for examination (APHA, 1992).

2.2. Determination of acidity%

Titratable acidity (TA) (as lactic acid %) of cream, Laban rayeb, pasteurised milk and UHT milk was measured following the description by AOAC (2000). Briefly, 10 ml of well-mixed samples were placed in a clean porcelain dish and diluted with 20 ml of CO2 free water. One ml of 1% phenolphthalein (alcoholic solution) was added. After thoroughly mixing, the contents were titrated against N/9 sodium hydroxide solution to the first persistent pink shade. The acidity per cent was calculated according to the following formula:

Acidity % = R/10
R= No. of ml of N/9 NaOH used in titration

2.3. Preparation of samples for microbiological examination

Eleven ml of well-mixed samples was added to 99 ml of sterile peptone water 0.1% to make a dilution of 1/10 from which 10-fold serial dilutions were made (Oxoid, Ltd, Basingstoke, Hampshire, UK)

2.4. Total bacterial count

One ml of each dilution was transferred into duplicated labelled Petri dishes 12–15 ml of liquefied sterile plate count agar at 44°C–46°C were poured into each plate, then incubated at 35°C for 48 h. Negative control sterile plate count agar was used. Plates that had 30 to 300 colonies were counted (Oxoid, Ltd, Basingstoke, UK)

2.5. Total coliforms count (MPN) technique

The test was performed using lauryl sulphate tryptose broth (LST) and Brilliant-green Lactose Bile 2% broth with inverted Durham's tubes according to (APHA, 1992).

2.6. Faecal coliform count (MPN/ml)

A loopful from each positive LST broth was inoculated in sterile tubes of *E. coli* broth (EC broth). The inoculated tubes, as well as the control ones, were incubated in a thermostatically controlled water bath at 44.5°C for 48 h. Positive tubes showing gas production were recorded. (APHA, 1992).

2.7. *E. coli* count, biochemical identification, and serology

A loopful from each positive EC broth tubes (showing gas production) was streaked onto Eosin Methylene Blue agar (EMB) (Oxoid, Ltd, Basingstoke, UK). The inoculated plates, as well as the control negative ones, were incubated at 35 + 1°C for 24 h. The plates were examined for typical nucleated, dark centred colonies with or without a green metallic sheen. Two typical colonies were transferred to plate count agar slant. Slants were incubated at 35°C for 18–24 h, and the purified colonies were submitted for further biochemical identification, done using four tests: indole, methyl red, Voges-Proskauer, and citrate utilisation (APHA, 1992).

Serological characterisation of *E. coli* isolates was carried out using the slide agglutination method with polyvalent and monovalent antisera. The isolates were first tested with OK polyvalent antisera. Briefly, two separate glass slides were used. A saline solution was added to the glass slide, followed by the addition of a portion of a colony from the suspect culture, mixed to form a smooth, dense suspension. To the first glass slide (control) only a drop of saline was added and mixed. To the second, an undiluted antiserum was added then tilted back and forward for one minute. Agglutination was observed using indirect lighting over a dark background. When a colony gave a strongly positive agglutination with one of the pools of poly-

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valent serum, a further portion was inoculated onto a nutrient agar slant (Oxoid, Ltd, Basingstoke, Hampshire, UK) and incubated at 37°C for 24 h to grow as a culture for testing with O monovalent antisera for serogroups O26, O55, O86, O111, O114, O119, 125, O126, O127, O142 and O158. The strains belonging to the same serogroups and isolated from the same samples were reported only once. Positive control strains obtained from National Research institute; Cairo were included in each experiment run.

2.8. Detection of virulence genes in *E. coli* using PCR.

2.8.1. Extraction of DNA

DNA was extracted using QIAamp DNA Mini Kit (Qiagen, Hilden, Germany). Briefly, 1.5 ml of an overnight broth culture of *E. coli* grown in MacConkey broth at 37°C was centrifuged in a benchtop centrifuge at 8000 rpm for 5 min and the supernatant discarded. The cell pellet was resuspended in PBS to a final volume of 200 ml. QIAGEN protease (20 ml) was pipetted into the bottom of a 1.5 ml microcentrifuge tube then 200 ml of the sample and 200 ml buffer AL were added and mixed by pulse vortexing for 15 seconds. After that, the mixture was incubated at 56˚C for 10 min and centrifugated to remove drops from inside the lid. 200 ml ethanol (96%) were added to the sample and mixed again by pulse vortexing for 15 seconds. After mixing, centrifugation was used to remove drops from inside the lid. The mixture was carefully applied to the QIAamp Mini spin column (in a 2 ml collecting tube) for DNA extraction. The DNA concentration was measured using a spectrophotometer (DU530, Beckman, CA). An average of 10 mg of DNA was obtained.

2.8.2. Cycling conditions of the primers during PCR.

The *fimH*, *aroA*, *Stx1* and *Stx1* genes for *E. coli* were amplified by a multiplex PCR as described by (Dipineto et al., 2006; Ghanbarpour and Salehi, 2010; La Ragione et al., 2013) as shown in (Table 1). DNA (6 ml of 30–40 ng/ml) was assayed in a 25 µL reaction mixture containing 12.5 µL of Emerald Amp GT PCR master mix (2x premix), 4.5 µL of PCR grade water, 1 ml of forward primer (20 pmol) and 1 ml of reverse primer (20 pmol) according to Emerald Amp GT PCR master mix (Takara), code number RR310AKit. The initial denaturation for *fimH* was for 5 min at 94°C followed by 35 cycles of 94°C for 30s, 50°C for 30s, 72°C for 45s, and a final extension at 72°C for 7 min. The initial denaturation for *Stx1* and *Stx2* was for 5 min at 94°C followed by 35 cycles of 94°C for 30s, 58°C for 40 s, 72°C for 45s, and a final extension at 72°C for 10 min. Lastly, the initial denaturation for *aroA* was for 5 min at 94°C followed by 35 cycles of 94°C for 30s, 50°C for 40 s, 72°C for 1.2 min, and a final extension at 72°C for 12 min. Running gel electrophoresis of 20 ml of the reaction product in a 1.5% agarose gel (AppliChem, Ottoweg 4 Darmstadt, Germany) at 1–5 volts/cm of the tank length for 30 min and the gel was transferred to UV cabinet and photographed by gel documentation system (Alpha Innotech, Biometra, San Francisco, USA), and the data were analysed using computer software. The experiment was repeated three times. The DNA was extracted from the positive control reference strains obtained from the National Research Institute, Cairo, Egypt (Sambrook et al., 1989).

2.9. Enumeration, isolation, and identification of *S. aureus*

One hundred microliters from each dilution were evenly spread over a dry surface of Baird parker agar plates (Oxoid, Ltd, Basingstoke, UK) by using a sterile L-shaped bent glass rod. Streaked plates, as well as the control ones, were incubated at 37°C for 24 h. Suspected colonies (black, shiny with a narrow white margin and surrounded by a clear zone extending into the opaque medium) were counted. The plates were re-incubated for another 24 h before being counted again for further growth. Suspected colonies were picked up and streaked onto agar slants for further identification, which was done using catalase test, citrate utilisation, urease production, and coagulase test (APHA, 1992).

3. Results and Discussion

3.1. Acidity values

The titratable acidity % in the examined fluid cream, Laban rayeb, pasteurized milk, and UHT samples (Table 2) was ranged from 0.01to 0.79, 0.10 to 1.5, 0.1 to

0.25 and 0.13 to 0.17, respectively with a mean value of 0.19 ± 0.04, 0.89± 0.05, 0.15 ± 0.01 and 0.15 ± 0.002, respectively.

Titratable acidity of milk and milk products is considered an index of quality (Griffiths et al., 1988). Other publications reported the acidity percentages in milk and dairy products. In fluid cream, it was 0.20 ± 0.01(Meshref, 2013) and in Laban rayeb, it was 0.68 ± 0.14 (Ahmed et al., 2014). Increased acidity in the fresh cream may be attributed to milk sitting for long periods at room temperature (20–25°C) before the process of separation for long periods, during which lactic acid-producing bacteria and other types of harmful bacteria flourish. The use of dirty utensils and milk pots, in addition to the unclean hands of milkers, constitute the most important sources of milk contamination with lactic acid bacteria (Robinson, 2002). Milk fermentation converts lactose into organic acids, including acetic acid and lactic acid, which decreases the pH of the milk from 6.8 to less than 4.6, thus lowering the risk of fermented milk being contaminated with pathogens (Al-Kadamany et al., 2001).

Table 1. Primers sequences used for detection of *E. coli*

Gene	Primer sequence (5'-3')	Length of amplified product	Reference
fimH	TGCAGAACGGATAAGCCGTGG GCAGTCACCTGCCCTCCGGTA	508 bp	Ghanbarpour and Salehi (2010)
Stx1	ACACTGGATGATCTCAGTGG CTGAATCCCCCTCCATTATG	614 bp	Dipineto et al. (2006)
Stx2	CCATGACAACGGACAGCAGTT CCTGTCAACTGAGCAGCACTTTG	779 bp	
aroA	ATCCCTGACGTTACAACC TCCGCGCCAGCTGCTCGA	1261 bp	La Ragione et al. (2013)

Table 2. Ttitratable acidity% of dairy samples (n=120) collected from El Fayoum Governorate, Egypt.

Samples	No	Min	Max	Mean ± SE
Cream	30	0.01	0.79	0.19 ± 0.04
Laban rayeb	30	0.10	1.50	0.89 ± 0.05
Pasteurized Milk	30	0. 1	0.25	0.15 ± 0.01
UHT milk	30	0.13	0.17	0.15 ± 0.002

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The bacterial count in fluid dairy products potentially reveals the general conditions of sanitation and temperature control under which fluid dairy products were produced, handled, and held. The TBC of fluid cream, pasteurised milk and UHT milk ranged from 2×10^5 to 3×10^6, 1×10^2 to $1.0^5\times10^4$ and <10 CFU/ml, with a mean count of $1.68\times10^6 \pm 1.3\times10^5$, $4.3\times10^3 \pm 6.66\times10^2$ and 0 CFU/ml, respectively (Table 3).

In previous studies, the mean values of TBC in fluid cream were 1.8×10^3 CFU/ml (Halpin-Doshnalek & Marth, 1989) and 8.72×10^4 CFU/ml (Meshref, 2013). In pasteurised milk, higher values were reported by Dey & Karim (2013), who mentioned that the values of TBC ranged from 1.8×10^4 to 9.6×10^5 CFU/ml. Additionally, higher levels of TBC in pasteurised milk were reported by Silva et al. (2010), Koushki et al. (2016). They mentioned that 46.5% of the samples had a high total microbial count above 10^6 CFU/ml. The TBC of UHT milk must not be more than 10 CFU/ml (Egyptian Standards, 2005). The TBC of the UHT milk samples was <10, indicating their excellent sanitary quality (Table 3). High levels of TBC in UHT milk were reported by Shojaei & Yadollahi (2008) and Ayad et al. (2009) with mean values of 7.1×10^1 and 3.4×10^1 CFU/ml, respectively.

High TBC counts in fresh unpasteurised cream samples can be attributed to the lack of health knowledge among cream staff, the presence of residues of water on the separator surface that promotes the growth and multiplication of bacteria resulting in milk contamination, the use of dirty utensils, poor personal hygiene and the lack of heat treatment that contributes to the poor hygienic quality of fresh cream (Hayes & Boor, 2001). Although higher counts in pasteurised milk could be attributed to a defect in the pasteuriser, bacteria surviving pasteurisation, and post-pasteurisation contamination due to problems in processing, handling, and bad personnel hygiene (Koushki et al., 2016). Therefore, training and guidance should be given to farmers regarding general milking hygienic practices, pasteurisation of milk used in cream manufacturing, and regular cleaning and sanitation of the separator used for cream production after each production process to avoid microbial growth and lengthen the shelf life.

3.3. Total coliform, Faecal coliform and *E. coli*

Total coliforms were detected in 100, 16.66 and 23.33 % of the examined fluid cream, Laban rayeb and pasteurised milk samples with a mean value of $1.14 \times 10^5 \pm 3.9 \times10^4$, 1.53 ± 0.79 and 2.53 ± 1.01 MPN/ml, respectively (Table 4). None of the examined UHT samples contained total coliform.

In Egypt, Meshref (2013), found a mean value of $4.21\times10^6 \pm 9.82\times10^5$ in fluid cream. In Hungary, Varga (2007) stated that none of the examined cream samples contained detectable levels of coliforms. There are many reasons for these differences, including different health practices during milking, the difference in climatic changes and lack of hygiene of the herd, polluted water, geographical distribution, equipment that are improperly maintained and washed and unhealthy milking procedures (Hossain et al., 2011).

Table 3. Count of TBC for the examined dairy products (n=120) sampled from El Fayoum Governorate, Egypt.

Sample type	Positive samples %	Min	Max	Mean ± SE
Cream	100	2×10^5	3×10^6	$1.68\times10^6 \pm 1.3\times10^5$
Pasteurized milk	100	1×10^2	1.05×10^4	$4.3\times10^3 \pm 6.66\times10^2$
UHT milk	0	<10	<10	0

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Table 4. Incidence and mean count of Total coliform, Fecal coliform and *E. coli* in the examined dairy products (n=120) sampled from El Fayoum Governorate, Egypt.

Sample type	Total coliform count (MPN/ ml)		Fecal coliform count (MPN/ ml)		*E. coli* count (MPN/ ml)	
	Positive %	Mean ± SE	Positive %	Mean ± SE	Positive %	Mean ± SE
Cream	100	$1.14\times10^5 \pm 3.9\times10^4$	100	$1.87\text{x}10^4 \pm 8.18\times10^3$	100	$2.25\text{x } 10^3 \pm 8.63\text{x}10^2$
Laban rayeb	16.66	1.53 ±0 .79	0	0 ± 0	0	0
Pasteurized milk	23.33	2.53 ± 1.01	0	0 ± 0	0	0
UHT milk	0	0 ± 0	0	0 ± 0	0	0

Higher results of coliforms in Laban rayeb were reported by Ahmed et al. (2014), who revealed coliforms were present in 17.5% of the examined samples with a mean value of $2.5\times10^4 \pm 4.5\times10^4$ CFU/ml. The high number of coliform is a sign of poor hygienic processing conditions and post-processing contamination. Higher results of coliforms in pasteurised milk were reported by Koushki et al. (2016), who revealed that 76.6% of samples had coliform. Similar results for coliforms in UHT were reported by Al-Tahiri (2005) and Banik et al. (2014). Still, a higher result of total coliforms in UHT milk was obtained by Shojaei & Yadollahi (2008), which could be attributed to secondary bacterial contamination, and or the type of packaging (Tortorello, 2003).

According to Robinson (2002), the total coliform count in fresh cream should be less than 30 CFU/ml. This study found that all fresh cream samples (100%) were above this limit. The contamination of samples with coliform is due to many reasons, including direct faecal pollution, lack of personal hygiene and poor sanitary practices during the milking and handling process, which poses a potential hazard to people consume these products.
Unfortunately, there are no regulations about the production or consumption of unpasteurised dairy products in Egypt; however, Egyptian Standards mention the limits of some pathogens in raw milk and some dairy products. According to Egyptian Standards (2005), the permissible limit of coliforms in fresh cream, Laban rayeb, and pasteurised milk should be no more than10 MPN/ml, 100% of examined cream was incompatible with the legal standard (Table 5). On the other hand, 16.66% of Laban rayeb was incompatible with the legal standard, 23.33% of pasteurised milk was incompatible with the legal standard, and all UHT milk samples were compatible with the standards. Pasteurised milk should not contain any coliform bacteria because it cannot withstand the pasteurisation temperature. The occurrence of bacterial contamination in pasteurised milk may be attributed to a defect in the pasteuriser or post pasteurisation contamination due to bad handling conditions (Banik et al., 2014).

Faecal coliforms and *E. coli* were detected in 100% of the examined fluid cream samples with a mean value of $1.87\times10^4 \pm 8.18\times10^3$ and $2.25\times10^3 \pm 6.63\times10^2$ MPN/ml, respectively. Faecal coliforms and *E. coli* of each of the Laban rayeb, pasteurised milk and UHT-processed milk samples were <3 CFU/ml (Table 4). Failure to find *E. coli* in the examined Laban rayeb samples may be attributed to the lower pH value. Several studies were able to detect and isolate *E. coli* from Laban rayeb (Olasupo et al., 2002) and pasteurised milk (El Zubeir et al., 2008; Vahedi et al., 2013).

Egyptian Standards (2005) stated that milk products should be free from any *E. coli* yet, 100% of the examined cream was incompatible with the legal standard. On the other hand, Laban rayeb, Pasteurised milk, and UHT milk samples were compatible with the standard. Coliform count and *E. coli* contamination are indicators of faecal contamination caused by using unpasteurised milk in the manufacturing of dairy products, pasteurisation deficiency, secondary contamination, and type of packaging (Tortorello, 2003).

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Table 5. Acceptability of the examined dairy products (n=120) sampled from El Fayoum Governorate, Egypt based on *E. coli* count according to Egyptian standards (2005)

Product	Permissible limit of *E. coli*	Acceptable samples %	Unacceptable Samples
Cream	0 CFU/ml	0	100
Laban rayeb	0 CFU/ml	100	0
Pasteurized milk	0 CFU/ml	100	0
UHT milk	0 CFU/ml	100	0

3.4. Virulence genes and the serological analysis in *E. coli*

Serological identification of 30 isolates of *E. coli* was serotyped to O125, O157and O158 with an incidence of 53.33%, 33.33%, and 13.33%, respectively (Table 6). Four virulent genes were identified in all *E. coli* strains (Table 6 and Figure 1). Each of the *aroA* gene and *fimH* gene were detected in all serotyped *E. coli* with incidences 100%, 100% and 100% for O125, O157and O158. Moreover, the *Stx1* and *Stx2* genes were not detected in all serotyped *E. coli*.

Shiga toxin-producing *E. coli* (STEC) are considered the main causative agents of hemorrhagic colitis (HC) and hemolytic-uremic syndrome (HUS) (Aidar- Ugrinovich et al., 2007). Consumption of undercooked meat, non-pasteurised dairy products and vegetables, and water contaminated with faeces are some of the possible routes for STEC human exposure (Hussein and Bollinger, 2005). Similar results were detected by Carneiro et al. (2006). They reported that the *Stx1* and *Stx2* genes were not detected in *E. coli* isolated from pasteurised cow milk sold in Rio de Janeiro, Brazil. Various studies have investigated the virulence genes of STEC in unpasteurised milk and its derivatives (Paneto et al., 2007; Solomakos et al., 2009; Islam et al., 2010; Rantsiou et al., 2012).

A study by Khairy et al. (2019) mentioned that the *fimH* gene was the most prevalent virulent gene (66.9% and 91.4%) in uropathogenic *E. coli* (UPEC) and diarrheagenic *E. coli* (DEC) strains, respectively. Moreover, Biscola et al. (2011) showed that in EHEC strains, the *fimH* gene was conveyed by the majority of non O157:H7 *E. coli* strains (97%) and by all the O157:H7 *E. coli* strains. Attachment of *E. coli* to the urothelial cell surface is mediated by *fimH* adhesion leading to urinary tract infections (Wojnicz, 2007; Kaczmarek et al., 2012). All these findings indicate that *E. coli* strains isolated in this study from cream samples might contribute to public health hazards due to the presence of such virulence genes. Therefore, strict hygienic measures should be taken to mitigate and prevent such contamination, for example, using large scale products which are recommended to reduce such risk.

Even though we did not detect STEC genes, the presence of *E. coli* in fluid cream indicates inadequate sanitary hygiene practices. It does not exclude the possibility that other pathotypes of *E. coli* are present which can present a health risk to consumers.

3.5. Incidence of *S. aureus*

In the present study, 30 (100%) of fresh unpasteurised cream samples were contaminated with *S. aureus* (Table 7) with a mean count of $7.56\times10^4 \pm 8.81\times10^3$ CFU/ml, but was not detected in the Laban rayeb, pasteurised milk and UHT milk samples (< 10 CFU/ml). All positive samples were above the limits (100 CFU/ml) established by Robinson's standards (2002). Egyptian Standards (2005) stated that the permissible limit of *S. aureus* to be no more than 10^2 CFU/ml; therefore, 100% of the examined cream samples were incompatible with the legal standard. On the other hand, Laban rayeb, pasteurised milk, and UHT milk samples were compatible with the standard.

The incidence of *S. aureus* in unpasteurised cream in this study was higher than those reported by Varga (2007), who failed to detect *S. aureus* in the examined cream samples and Meshref (2013), who reported

Table 6. Prevalence of some virulence genes among *E. coli* strain (N=30) isolated from the examined dairy products sampled from El Fayoum Governorate, Egypt.

E. coli strain	Sample NO	(%)	No of detected genes			
			Stx1	*Stx2*	*fimH*	*aroA*
O125	16	53.33	0	0	16/16 (100%)	16/16 (100%)
O157	10	33.33	0	0	10/10 (100%)	10/10 (100%)
O158	4	13.33	0	0	4/4 (100%)	4/4 (100%)

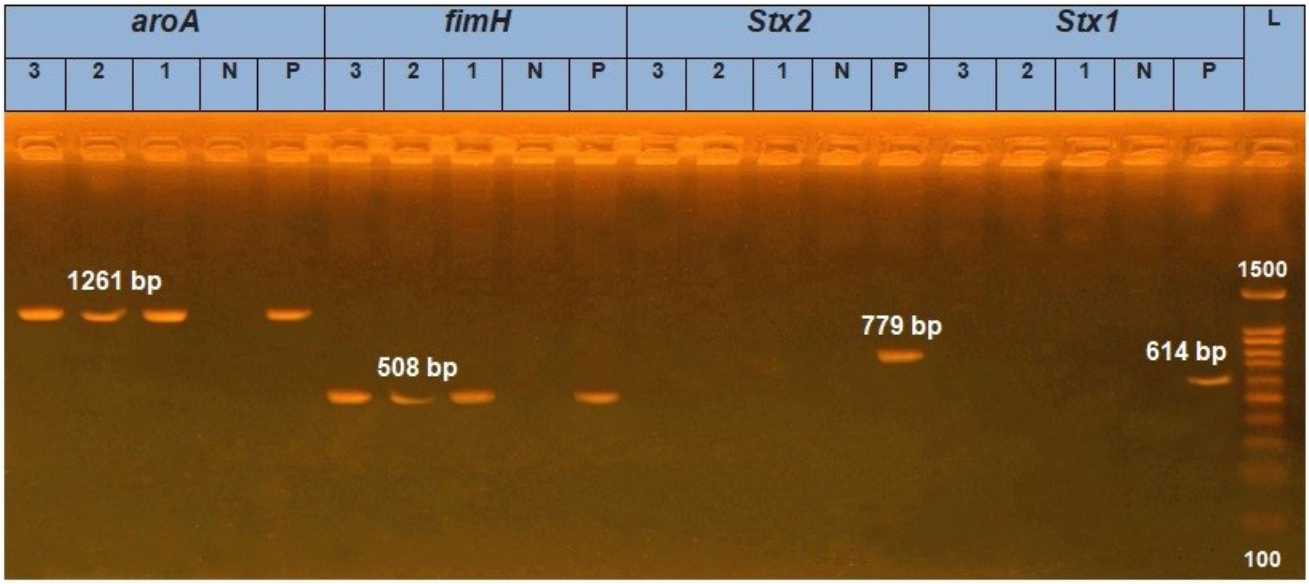

Figure 1. Agarose gel electrophoresis of PCR products after amplification of: 1- *fimH*, *aroA*, *Stx1* and *Stx2* genes for serologically identified *E. coli* strains, MWM-molecular weight marker (100 – 1500 bp DNA ladder), control (Positive, Negative), and different strains of *E. coli*. *fimH* gene products at 508 bp, *aroA* gene products at 1261 bp.

Table 7. Statistical analytical results of *S. aureus* in the examined dairy products (n=120) sampled from El Fayoum Governorate, Egypt.

Sample type	Positive %	Mean ± SE	Permissible limit of *S. aureus*	Acceptable samples %	Unacceptable Samples %
Cream	100	$7.56x10^4 \pm 8.81x10^3$	Not more than 10^2 CFU/ml	0	100
Laban rayeb	0	0 ± 0	Not more than 10^2 CFU/ml	100	0
Pasteurized milk	0	0 ± 0	Not more than 10^2 CFU/ml	100	0
UHT milk	0	0 ± 0	Not more than 10^2 CFU/ml	100	0

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that 12 % of the examined fluid cream samples were contaminated with *S. aureus*. On the other hand, Halpin-Dohnalek & Marth (1989) tested the ability of different strains of *S. aureus* on the growth and production of enterotoxin in sweet and sour cream samples. They concluded that sweet and fresh cream with varying fat percentages supports the growth of *S. aureus* to a level sufficient for enterotoxin production. Several publications approved that at growth rate above 10^3 CFU/ml, *S. aureus* was probably able to produce enterotoxins. The count of $7.56\times10^4 \pm 8.81\times10^3$ CFU/ml reported in this study is considered dangerous and supposes the production of enterotoxins in the samples, which could create a public health hazard (Tebaldi et al., 2008; Zeinhom et al., 2015).

Higher results in Laban rayeb was recorded by Ahmed et al. (2014) who reported that 93.3 % of the examined Laban rayeb samples were contaminated with *S. aureus* with a mean count of $11.9\times10^3 \pm 39.5\times10^2$ CFU/ml. Additionally, higher *S. aureus* count in pasteurised milk was recorded by Vahedi et al. (2013). Similar results of *S. aureus* in UHT milk samples were recorded by Al-Tahiri (2005).

Cows with mastitis are the reservoir of toxigenic *S. aureus* strains in raw milk. Keeping raw milk at high room temperatures before separating the cream contributes strongly to the growth and multiplication of *S. aureus*, which secretes enterotoxin. This result highlights the unhygienic handling and inadequate personal hygiene. This study has found that the count of *S. aureus* in fresh cream was less than 10^6 - 10^8 CFU/ml, noting that this number is required for food poisoning to occur (Kerouanton et al., 2007). Moreover, the finding still presents a public health hazard, as sufficient toxins remain to elicit symptoms of staphylococcal food poisoning (Bennett and Monday, 2003). Therefore, we recommend the application of general health practices for local cream manufacturers to reduce bacterial contamination of cream and milk products, consistent food safety education, and the application of public health standards that would make a significant positive impact on food safety knowledge and hygiene practices of food handlers (Mgqibandaba et al., 2020).

4. Conclusion

The fresh cream produced by farmers in El Fayoum province, Egypt, is unsuitable for human consumption due to high microbial counts of SPC, *E. coli* and *S. aureus*. Using raw milk in cream manufacturing and separators are the main sources of cream contamination and frequently, the principal causes of high bacterial counts. The presence of pathogenic bacteria such *E. coli* and the prevalence of virulence genes specially *fimH* gene and *S. aureus*, may pose a risk for public health. Therefore, it is desirable to improve the hygienic status of locally produced fresh cream through educating the farmers in general hygienic practices and handling and storage of products to protect them from infection and deterioration. Also, information on health hazards associated with consumption of raw unpasteurised milk should be publicised, so that consumption of untreated raw milk and its products can be minimised. We plan to conduct a more extensive survey of cream samples to better assess the overall quality and variability in the quality of fresh cream.

Conflict of interest

The authors declare no conflict of interest.

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The first online edition of the Organic Innovation Days 2020 was a success

https://tporganics.eu/organic-innovation-days/

Between 24-25 November 2020 the the Organic Innovation Days 2020 took place online via the online event platform SpotMe for the first time ever. The event was well attended by almost 200 participants.

The **Organic Innovation Days 2020 is** the only EU event on research & innovation for organic. It is an annual public event organized by TP Organics.
The main aim this year was to boost organic seed and plant breeding across Europe. This year edition, TP Organics partnered with the Horizon 2020 project LIVESEED, coordinated by IFOAM Organics Europe.

Through interactive functionalities such as chats, Q&As and discussion boards, the Organic Innovation Days once again provided a unique opportunity to meet members of TP Organics, to network with EU stakeholders and decision-makers, as well as to discuss and exchange with the LIVESEED project partners.

More information about the meeting under:

https://tporganics.eu/organic-innovation-days/

To read TP Organic Paper:

https://tporganics.eu/wp-content/uploads/2020/03/tporganics-positionpaper-horizoneurope-1st-work-programme-final.pdf

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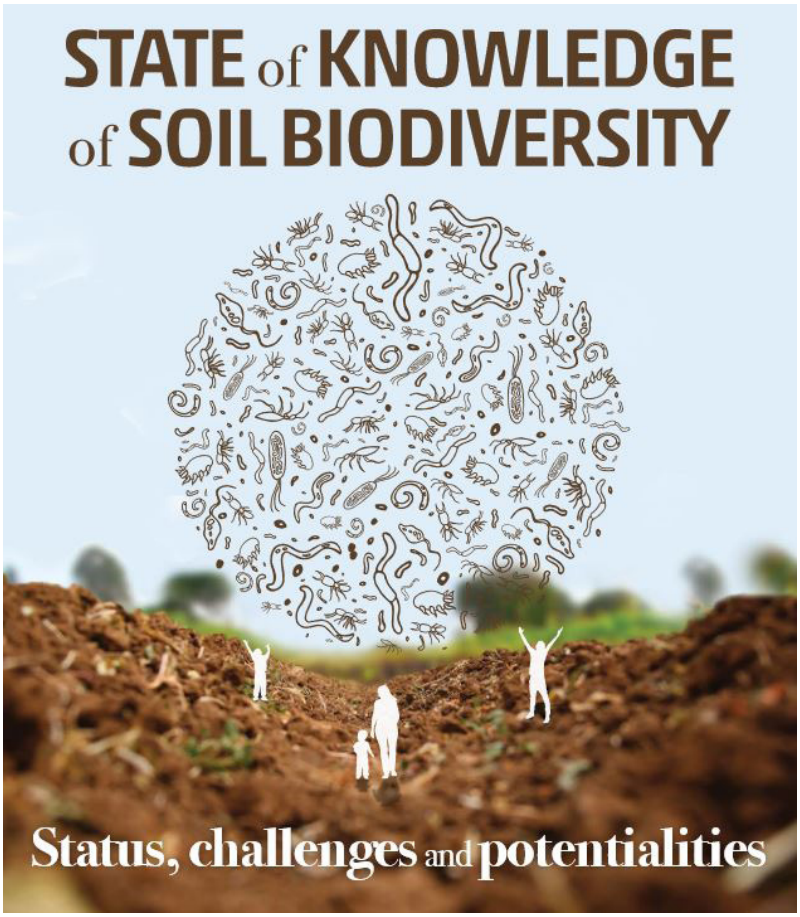
State of knowledge of soil biodiversity - Status, challenges and potentialities



A new interesting report published by FAO is dealing with very important challenges and global concepts such as biodiversity; soil organisms; ecosystem services; ecosystem conservation; Sustainable Development Goals.
Biodiversity is receiving increasing attention with regards to food security and nutrition. Aboveground biodiversity such as plants and animals is taking higher attention by scientists that biodiversity beneath our feet, soil biodiversity, which drives many processes that produce food or purify soil and water.
This report published by FAO with the collaboration of FAO's Global Soil Partnership and its Intergovernmental Technical Panel on Soils, the Convention on Biological Diversity, the Global Soil Biodiversity Initiative, and the European Commission. It highlights the importance of soil biodiversity, the threats to it, and the solutions that soil biodiversity can provide to problems in different fields. Besides, it explores the valuable contribution to raising awareness of the importance of soil biodiversity and highlighting its role in finding solutions to today's global threats.

http://www.fao.org/3/cb1928en/CB1928EN.pdf

The Climate Ambition Summit 2020 celebrated this year five years of the adoption of the Paris Agreement

https://ec.europa.eu/info/index_en

The summit took place with s75 leaders, including 45 relating to new and enhanced Paris Agreement nationally determined contributions (NDCs), 24 net-zero emissions commitments, and 20 new adaptation and resilience plans. New finance-related initiates were made by different countries and financial institutions. For instance, the United Kingdom pledged to double its climate finance contribution to USD 15.5 billion over the next five years. Additionally, the European Investment Bank announced a goal of 50% of investments that aim to support the climate and environment sectors by 2025.

Moreover, China has committed to lowering its carbon dioxide emissions per unit of GDP by over 65% from 2005 levels by 2030 and the EU has stated commitments to reduce GHG emissions by at least 55% from 1990 levels by 2030. Numerous countries announced or affirmed their commitment to reaching net-zero carbon dioxide or GHG emissions by mid-century.

More information bout the outcome of the summit and the words od some leaders can be found in:

https://enb.iisd.org/climate/ambition-summit-2020/12dec.html?utm_medium=email&utm_campaign=ENB%20Update%20%2013%20December%202020%20AE&utm_content=ENB%20Update%20%2013%20December%202020%20AE+CID_121dd5b5c58ebf764066f5072ba41777&utm_source=cm&utm_term=Read

Reference:

IISD Reporting service. Climate Ambition Summit 2020. Published in 12 December 2020. Retrieved on 16.12.2020

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European parliament greenwashes farming subsidies and recovery funds

The European Parliament has announced new support for EU farm that will last for the next two years. The Parliament also agreed on how the recovery funds will be spent in the sector. However, this news is considered to have a negative impact on agricultural resilience and the environment. The European Parliament discussed a two-year transition deal extending current farm subsidy rules and focused on how to distribute the €8 billion agriculture share of the EU coronavirus recovery package. Unfortunately, the politicians chose on the greenwashing and status quo instead of the resilience and environmental sustainability that is much-needed.

For more information please visit:

https://meta.eeb.org/2020/12/15/european-parliament-on-course-to-greenwash-farming-subsidies-and-recovery-funds/

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Our solutions are in nature

The International Day for Biological Diversity

https://globalforestcoalition.org/forest-cover-61/

#OurNatureIsNotYourSolution

In May 22nd the International Day for Biological Diversity took place with the theme "Our solutions are in nature" that was chosen by the United Nations Convention on Biological Diversity (CBD).

The nature-based solutions (NBS) is increasingly becoming a strategy for reducing climate change and biodiversity loss. Unfortunately, many companies and governments have twisted the concept of NBS in order to falsely re-brand highly damaging practices as "green".

Therefore, the campaign #OurNatureIsNotYourSolution is launching a special edition Forest Cover magazine. Forest Cover highlights how the publicity of NBS is being exploited to cover actions such as pushing forest offsets, monoculture tree plantations and other false solutions. It also examines some real solutions that the members in Colombia, Ghana, Nepal, Panama, Paraguay and Sri Lanka are engaged in.

For more information, please visit:

https://globalforestcoalition.org/forest-cover-61/

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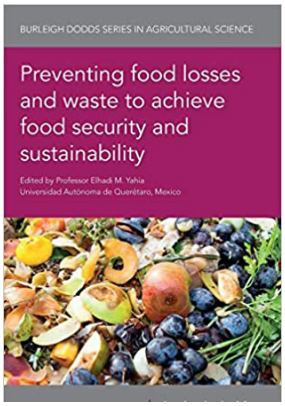

Preventing Food Losses and Waste to Achieve Food Security and Sustainability

A review by Nayram Ama Doe

Author: Elhadi M. Yahia
Publisher: Burleigh Dodds Science Publishing Limited
Published year: 2020
Language: English
ISBN: 9781786763037
Length: 853 pages

Food security is considered an important issue globally and can be linked directly and indirectly with climate change. Climate change attributed to greenhouse gas increase, temperature and humidity changes, directly affect quantity and quality of food produced, hence seriously impacting food security. This book is one of the recent books that presents an overview of food security and the impact of climate change on food security and sustainability. The book is divided to five different chapters for easy dissection by readers to facilitate their understanding. The book starts off by defining the concept of food security and stating the main pillars that form the solid base of the food security such as food availability, access, utilization and stability. Besides, it discusses important case studies in both rural and urban areas. Presenting those case studies is considered essential to change the common perspective of food security being occurred only in the rural area and highlights the fact that it can also appear in urban areas.

The first chapter of this book addresses in-depth the issue of sustainability, as well as food loss and waste. The chapter clears up some definitions and terminologies associated with food loss and waste, and the causes and methods for estimating food loss and waste. Moreover, it explores the main causes behind food loss and waste issue such as crop damage by insects, rodents and birds, damages due to unfavorable weather conditions such as flood and drought and the use of inappropriate harvesting methods, as well as estimating this issue like direct quantification through food loss and waste composition analysis, surveys, inventories and kitchen diaries. One fascinating aspect of this part of the book is the association between life cycle of the supply chain and the positive and negative socio-economic effect of food waste and loss. The author does not only focus his writing on the economic part of food waste but also broadens his writing scope by considering the impact of food loss and waste on the environment. This chapter also underlines the importance of food safety regulations as a defence against food waste and loss.

Food loss and waste can be identified along all the parts from farm to fork strategy. The second chapter of this educative book throws more light on food waste and loss along the supply chain, demonstrating the leading causes as well as solutions to this problem such as alteration of food packaging, campaigning to increase awareness and increasing the shelf life of these food products. This chapter also gives detailed breakdown, explanation and analysis of various areas where food losses occur from farm to fork, specifically during food production, processing, transportation and finally at the consumer level.

Food loss and waste can be noticed in any food category, However, some food groups have the higher possibility of food loss and waste such as cereals and grains, fruits and vegetables, roots and tubers and animal proteins. Chapter three studies those food groups exploring the losses during retail marketing and consumption, notwithstanding issues that arise during the estimation of food waste and loss.

Different strategies to reduce food loss and waste was suggested during the last years. Chapter four conceptualizes reduction of food waste and loss strategies. It provides an overview of various investments and the involvement of private sectors in food waste and loss reduction strategies. This section gives an emphatic explanation of the importance of food banks in addressing the issue of food loss and waste which will go a long way in achieving food security.

Part 5, which is the concluding chapter of the book, pre-

sents regional case studies on challenges and initiatives in reducing food waste and loss in the United States, Europe, East and North Africa, sub-Saharan Africa, Latin America and the Caribbean.

Overall, this book was found to be very educative, insightful as it addresses issues about food security and sustainability. It provides in-depth knowledge on what one needs to know on sustainability, food security, food waste and food losses and can be recommended as a useful resource.

About the author:

Nayram Ama Doe is a master' student at the University of Kassel and Fulda University of Applied Sciences, Germany, studying International Food Business and Consumer Studies. Her research focus is on food sustainability, agriculture and food systems, and is very passionate about issues relating to food security and food supply chain

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CALL FOR PAPERS

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THE FUTURE OF FOOD JOURNAL
JOURNAL ON FOOD, AGRICULTURE & SOCIETY

Special Issue on Sustainable Agriculture & Food Systems

Current environmental challenges, global warming, climate change and the loss of biodiversity and natural resources are in one way or another linked to human behaviour. Unsustainable production methods and individual consumption could explain most of these challenges. These global issues are encouraging people to adopt better pro-environmental practices. Sustainable agriculture and sustainable food systems are helping meet society's current food needs, as well as textile and energy needs, without compromising the needs of future generations. However, there is still a worldwide debate about the relationship between agriculture and nature conservation. For example, how much arable land should be used for commodities linked to textile (such as cotton) or energy production (e.g. maize)? Still, sustainable agriculture is key to fostering food safety and sovereignty. Therefore, researchers and practitioners are required to strive and integrate the concepts, benefits and consequences of more sustainable agriculture and food systems in their work-related efforts.

Future of Food Journal is currently running a special issue entitled "Sustainable Agriculture & Food Systems". This special issue aims to highlight original research articles, researcher's opinions, news and book reviews on the related topic.

The topics include but are not limited to:

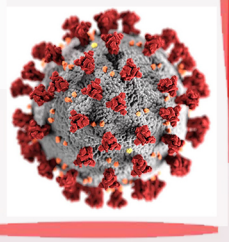
- Sustainable agricultural practices in different countries
- Economic, social and political context of value chains
- Food production and transformation e.g. urban agriculture
- Food consumption and Food education programs
- Farming and natural resources (e.g. biodiversity, climatic relevant emissions, water)
- Emerging trends and new technologies in sustainable agriculture and food systems

FOFJ is a free-of-charge, peer-reviewed and open-access online journal for international scholars and researchers supported by the University of Kassel and the Federation of German Scientists (VDW).

For further details on the submission process, please see the instructions for authors at the journal website:

http://www.thefutureoffoodjournal.com/index.php/FOFJ/information/authors

Special Call for Papers



THE FUTURE OF FOOD JOURNAL
JOURNAL ON FOOD, AGRICULTURE & SOCIETY

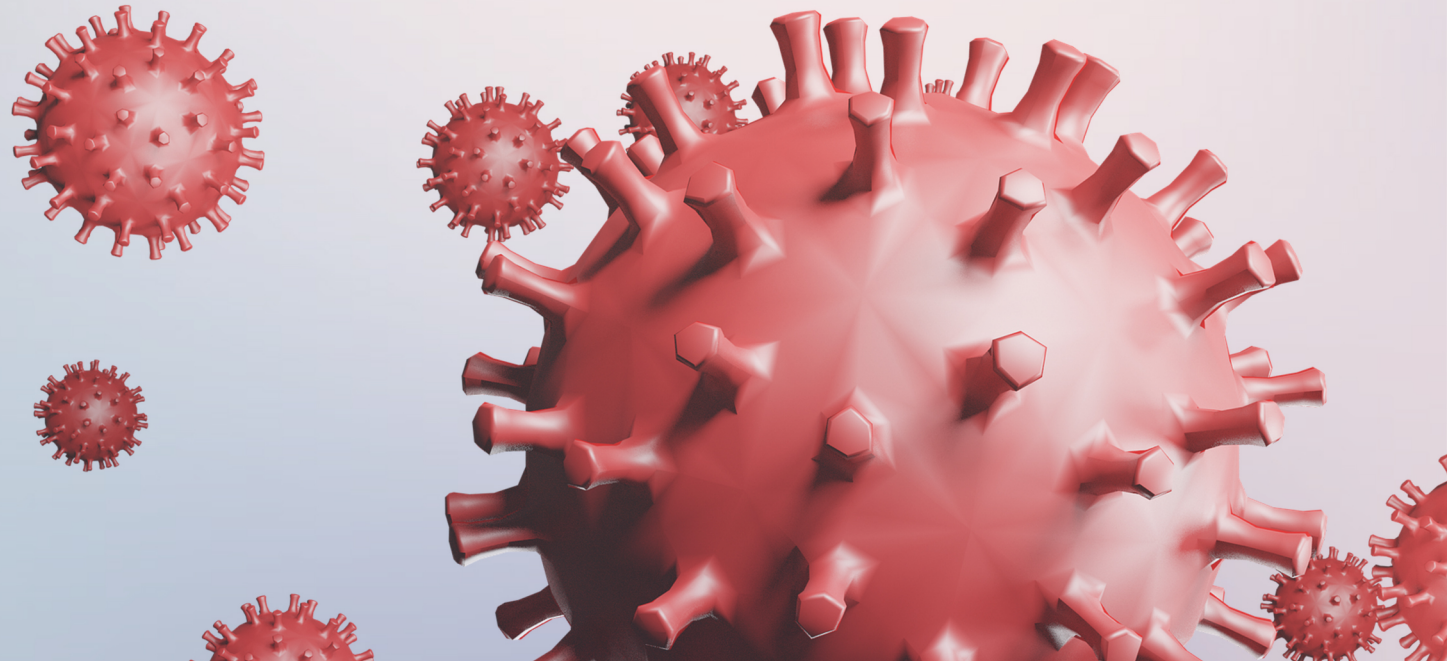
The multidimensional impacts of COVID 19 on the food systems

COVID 19 has been having multidimensional impacts on the food system, influencing food production, food trade, transport, and consumption. It also impacted water, energy, and labour supply, all directly linked to the food system. Nevertheless, the academic literature so far has been focusing on the measures adopted by governments during the pandemic, focusing on short term measures and solutions.
What is missing is a discussion on how COVID 19 is impacting the different dimensions of the food system both in the short term as well as in the long term.

This Special Issue call aims at developing such discussion, inviting scholars from different disciplines to engage in such an academic debate able to unpack and unfold the nuances behind impacts, responses, and implications. This would allow practitioners, policy makers, and scientists is to gain a better understanding of the problem at hand for the food system, on potential measures and solutions that could be adopted, and on their implications.

Furthermore, the special issue is also interested in understanding the how the pandemic is impacting the society and the people, including food producers and the most marginalised segments of societies, reflecting on how are peoples experiencing COVID-19 and what will be its long-term impact politically, economically, socially, and culturally? It encourages papers from a wide range of disciplines and methodological approaches.

Submission Guidelines - Deadline: December 31, 2020



Call for Reviewers

THE FUTURE OF FOOD JOURNAL
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Future of Food Journal is opining now a Call for Reviewers. Join us in our effort to reduce the manuscript processing lead time!

As the peer-review process is a fundamental criterion in scientific publication, the number of qualified reviewers is declining when the number of submissions is increasing. We are looking to expand our team of expert peer reviewers in the fields of:

1- Sustainable Agriculture
2- Sustainable Food system
3- Food Production & Technology
4- Nutrition and Diets
5- Environmental and Climate Sciences
6- Consumers Behaviour

And we would be delighted for you to join our team.

What to expect being a reviewer at FOFJ:

1- A great scientific experience
2- An acknowledgement in one of our published issues after the completion of 5 reviews
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4- 100 € after the completion of 5 reviews

Your duties would be to:

1- Review the assigned paper within max. 3 weeks
2- Review the manuscript once it has been accepted and revised within max. 1 week

Looking forward to receiving your application.

Please follow the link below for the new online registration process:

https://www.thefutureoffoodjournal.com/index.php/FOFJ/user/callReviewer

Thank you Reviewers

THE FUTURE OF FOOD JOURNAL
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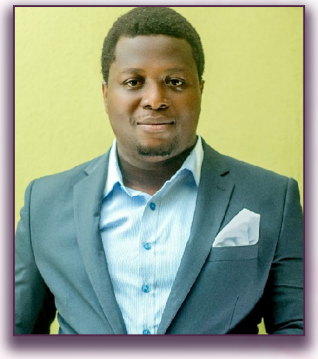
FOFJ appreciates the efforts and experience of all its highly qualified reviewers who contribute to the science and quality of research. Therefore, FOFJ thanks all the reviewers who dedicate time, knowledge, and effort to improve the quality of submitted manuscripts.
In this issue, FOFJ would like to extend a sincere Thanks to our reviewer **Dr. Babatunde Olarewaju** for his contribution in reviewing articles for Vol 8 Nr 2,3 and 4. As FOFJ launches a new Call of Reviewers, we hope to continue working with experienced academics to provide the best for our readers and authors.



Dr. Babatunde Olarewaju is a Food safety expert with B.Agric and Master of Philosophy (M.Phil) Degrees in Agricultural Extension and Rural Sociology

His interests are in Food Safety Management System, Quality Management System, training, youth capacity building and development, gender equity, and community driven development projects and consulting. He is currently the Lead Strategist of FutuX Agri-consult Limited, a private agricultural extension firm in Nigeria.

Babatunde had worked under different national and international projects with Action against Hunger, Palladium, Bill and Melinda gates Foundation, SADC Research centre, IFAD/FGN (VCDP), REGIC, El-Tayeb Trading Co. Ltd. Amongst others.

He was a licensed GlobalG.A.P Farm Assurer, Quality Management System (QMS), and GlobalG.A.P Risk Assessment on Social Practice (GRASP) till July 2020, and currently, a PECB certified ISO 22000 (Lead auditor) and had few articles published in International journals