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GOOD HANDLING PRACTICES, HYGIENIC-SANITARY CONDITIONS AND MINERAL COMPOSITION OF SURURU (*Mytella falcata*) SOLD IN STREET MARKETS IN ALAGOAS, BRAZIL

BOAS PRÁTICAS DE MANIPULAÇÃO, CONDIÇÕES HIGIÊNICO-SANITÁRIAS E COMPOSIÇÃO MINERAL DE SURURU (*Mytella falcata*) COMERCIALIZADO EM FEIRAS LIVRES DE ALAGOAS, BRASIL

BUENAS PRÁCTICAS DE MANIPULACIÓN, CONDICIONES HIGIÉNICO-SANITARIAS Y COMPOSICIÓN MINERAL DEL SURURU (*Mytella falcata*) VENDIDO EN MERCADOS AL AIRE LIBRE EN ALAGOAS, BRASIL

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ABSTRACT: The present study aimed to carry out a diagnosis of good handling practices (GHP), hygienic-sanitary conditions and concentrations of minerals in sururu (*Mytella falcata*) marketed in the street markets of the municipalities bordered by the lagoons that make up the Mundaú-Manguaba Estuarine-Lagoon Complex (MMELC) in dry and rainy season. A checklist was used to assist in the classification of the markets as to the compliance with the guidelines provided for by RDC No. 216/2004 – ANVISA. To investigate the minerals, samples were collected from all points of sale found, totaling 33 samples in the two research periods. The concentrations of iron (Fe), copper (Cu), manganese (Mn) and zinc (Zn) were analyzed using the atomic absorption spectrophotometry technique, and the concentration of lead (Pb) was analyzed according to specific protocol (SMEWW). With the application of the checklist, it was possible to classify the hygienic-sanitary conditions in all markets visited as unsatisfactory. As for the microminerals, regardless of the collection period, iron had the highest concentrations in all samples, surpassing, in overall means, by more than fifteen times the detected concentrations of copper, manganese and zinc. Regarding the toxic metal lead, the samples were within the limits allowed in bivalve mollusks. The results obtained with this study confirm the importance of sururu for countless families who sell it in street markets and reinforce the need for a joint effort of both vendors and those responsible for managing these spaces to provide the population of these localities with a favorable environment for food marketing.

Keywords: Bioindicators; Lead; Toxic metal; Bivalve mollusks; Seafood.

RESUMO: Com o presente trabalho, objetivou-se realizar um diagnóstico das boas práticas de manipulação (BPM), das condições higiênico-sanitárias e da concentração de minerais em sururu (*Mytella falcata*) comercializado nas feiras livres dos municípios margeados pelas lagunas que compõem o Complexo Estuarino-Lagunar Mundaú-Manguaba (CELMM) em período seco e chuvoso. Para tanto, utilizou-se de uma *checklist* para auxiliar na classificação das feiras quanto às adequações previstas pela RDC nº 216/2004 – ANVISA. Para a investigação dos minerais, foram adquiridas amostras de todos os pontos de venda encontrados, totalizando 33 amostras nos dois períodos da pesquisa. As concentrações de ferro (Fe), cobre (Cu), manganês (Mn) e zinco (Zn) foram analisadas por espectrofotometria de absorção atômica e, as de chumbo (Pb), conforme protocolo específico (SMEWW). Com a aplicação da *checklist*, foi possível classificar as condições higiênico-sanitárias em todas as feiras visitadas como insatisfatórias. Quanto aos microminerais, independentemente do período de coleta, o ferro foi o que apresentou as maiores concentrações em todas as amostras, chegando a superar, em médias gerais, mais de quinze vezes os valores detectados de cobre, manganês e zinco. Já em relação ao metal tóxico chumbo, as amostras estiveram dentro do limite permitido em moluscos bivalves. Os resultados obtidos confirmam a importância do sururu para inúmeras famílias que o comercializam em feiras livres e reforçam a necessidade de um esforço conjunto, dos feirantes e dos responsáveis pela gestão desses espaços, para proporcionar à população dessas localidades um ambiente propício à comercialização de alimentos.

Palavras-chave: Bioindicadores; Chumbo; Metal tóxico; Moluscos bivalves; Pescados.

RESUMEN: El presente estudio tuvo como objetivo realizar un diagnóstico de buenas prácticas de manipulación (BPM), condiciones higiénico-sanitarias y concentraciones de minerales en sururu (*Mytella falcata*) comercializado en los mercados ambulantes de los municipios bordeados por las lagunas que conforman el Complejo Estuarino-Lagunero Mundaú-Manguaba (CELMM) en época seca y lluviosa. Se utilizó una lista de chequeo para ayudar a clasificar los mercados en cuanto al cumplimiento de las directrices previstas por la RDC nº 216/2004 – ANVISA. Para investigar los minerales, se recolectaron muestras en todos los puntos de venta encontrados, totalizando 33 muestras en los dos períodos de la pesquisa. Se analizaron las concentraciones de hierro (Fe), cobre (Cu), manganeso (Mn) y zinc (Zn) mediante la técnica de espectrofotometría de absorción atómica, y se determinó la concentración de plomo (Pb) por el protocolo específico (SMEWW). Con la aplicación de la lista de chequeo, se logró catalogar como insatisfactorias las condiciones higiénico-sanitarias en todos los mercados visitados. En cuanto a los microminerales, independientemente del período de recolección, el hierro tuvo las concentraciones más altas en todas las muestras, superando, en medias globales, en más de quince veces las concentraciones detectadas de cobre, manganeso y zinc. Respecto al metal tóxico plomo, las muestras estuvieron dentro de los límites permitidos en moluscos bivalvos. Los resultados obtenidos con este estudio confirman la importancia del sururu para innumerables familias que lo venden en los mercados ambulantes y refuerzan la necesidad de un esfuerzo conjunto tanto de los vendedores como de los responsables de la gestión de estos espacios para brindar a la población de estas localidades un entorno favorable para comercialización de alimentos.

Palabras clave: Bioindicadores; Plomo; Metal tóxico; Moluscos bivalvos; Mariscos.

1. INTRODUCTION

Located in the South Central portion of the Alagoas coast, the Mundaú-Manguaba Estuarine-Lagoon Complex (MMELC) comprises a system of natural water bodies composed of the Mundaú and Manguaba major lagoons, access channels, several islands and an estuarine part common to both lagoons (ANA, 2006; SILVA; FERREIRA, 2018). Bathing the municipalities of Maceió (capital), Coqueiro Seco, Marechal Deodoro, Pilar, Rio Largo, Santa Luzia do Norte and Satuba, the MMELC is one of the most significant ecosystems in the state, not only for its extension, but mainly for its socioeconomic importance, since about 260,000 individuals depend, directly or indirectly, on this estuary for their livelihood and income (SILVA; SILVA; SOUSA, 2008).

Among the fishing resources present in the MMELC, the bivalve molusk sururu (*Mytella falcata*) is one of the most prominent, due to its volume of production and potential in generating income – primary or complementary to that of other remunerated activities (TAMANO et al., 2015). It is estimated that the production of 2007, estimated at 276.5 tons (COUTINHO et al., 2014), has generated approximately R$1,200,000.00 for the Alagoas communities benefited by the collection of this resource (AECID, 2008). The importance of the species *M. falcata* for about 10,000 families, mostly within a context of low socioeconomic conditions (PALMEIRA et al., 2016), combined with its reference in the cuisine and in various expressions of the local culture, such as music and literature (BEZERRA; SILVA-NETO, 2014), led to the recognition of this bivalve mollusk as Intangible Cultural Heritage of Alagoas.

Although sururu has components and nutritional values similar to those of other types of seafood, as is the case of macronutrients and vitamins (LIRA et al., 2004; SANTOS et al., 2014; GOMES et al., 2019), several studies have highlighted it as a significant source of microminerals, such as iron (Fe), copper (Cu), manganese (Mn) and zinc (Zn) (RAMOS, 2011; GIL; GIL, 2015; SANTOS; BOEHS, 2021). Among these, iron is the one that stands out the most, because it is possible to obtain, in a single meal, more than the daily value recommended by the National Health Surveillance Agency (ANVISA) in its Collegiate Board Resolution (RDC) No. 269, of September 22, 2005, which provides for the Recommended Daily Intake (RDI) of protein, vitamins and minerals (BRASIL, 2005; SANTOS et al., 2014). Such availability also justifies the indication of sururu as an alternative to beef in the fight against child malnutrition and anemia (SANTOS et al., 2014; CORREIA et al., 2018).

Despite the numerous benefits, some factors are determinant for the safe consumption of sururu. Its feeding mechanism based on the filtration of particles suspended in the aquatic environment (BRUSCA; BRUSCA, 2007) makes it susceptible to the incorporation of contaminants, both through what is ingested and through the portion soluble in water (RAINBOW, 2002). The contaminants most commonly related to the pollution of ecosystems similar to the MMELC are trace elements such as lead (Pb), present in the environment at low concentrations, but with high toxicity, bioaccumulation power and biomagnification power (CORREIA; FRAGOSO JR, 2011). In addition to not being biodegradable, this type of element combines with others, forming various molecules that cause the most varied effects on organisms, according to the degree of their absorption (PRIETO et al., 2008). The toxic effects of Pb are more noticeable in the nervous system, bone marrow and kidneys, but the gastrointestinal and reproductive systems can also be affected (MOREIRA; MOREIRA, 2004).

However, it is not only the fact that it is artisanally extracted from an ecosystem which has long suffered from pollution from domestic and industrial effluents that requires concern. Care in its handling during post-collection stages, including cooking, shucking, weighing and packaging (FREIRE; SILVA; SOUZA, 2011; SANTOS et al., 2014), as well as in the arrangement of the final product at the marketing sites, is also essential to ensure a food that does not pose risks to the health of consumers, considering its propensity to the proliferation of pathogenic microorganisms, such as viruses and bacteria (CROVATO et al., 2017).

Since street markets represent the main route for the flow of food such as sururu, factors related to physical facilities and the way the food is handled during its marketing are determinant for the safety of the product. In order to minimize the risks to the health of consumers, the RDC No. 216, of September 15, 2004, of the National Health Surveillance Agency (ANVISA), which provides for the Technical Regulation of Good Practices for Food Services, was created (BRASIL, 2004). This regulation helps detect irregularities and guide vendors who, in many cases, have never participated in training on the hygienic handling of food.

Thus, the objective with this study was to carry out a diagnosis of good handling practices and hygienic-sanitary conditions, as well as mineral composition, of sururu marketed in the street markets of the municipalities bordered by the lagoons that make up the MMELC.

2. MATERIALS AND METHODS

This research consists of a field study, with a qualitative-quantitative approach, given the collection of data by observation and the statistical treatment applied to the data obtained, being classified as descriptive research, since it also aimed to identify the correlation between the results of the mentioned methods.

The field study was carried out in street markets in the cities of Maceió (Tabuleiro do Martins district), Marechal Deodoro, Pilar, Rio Largo and Satuba, which border the MMELC along with the municipalities of Coqueiro Seco and Santa Luzia do Norte (Figure 1), but these latter were not visited due to the absence of street markets in their territory. As street markets are found in various places of the capital, the one located in the neighborhood Tabuleiro do Martins, one of the most traditional in the city, was considered for the study. The choice also considered the proximity to the MMELC and its link to a structure with 242 concrete stalls for marketing the most diverse food products (MACEIÓ, 2020).

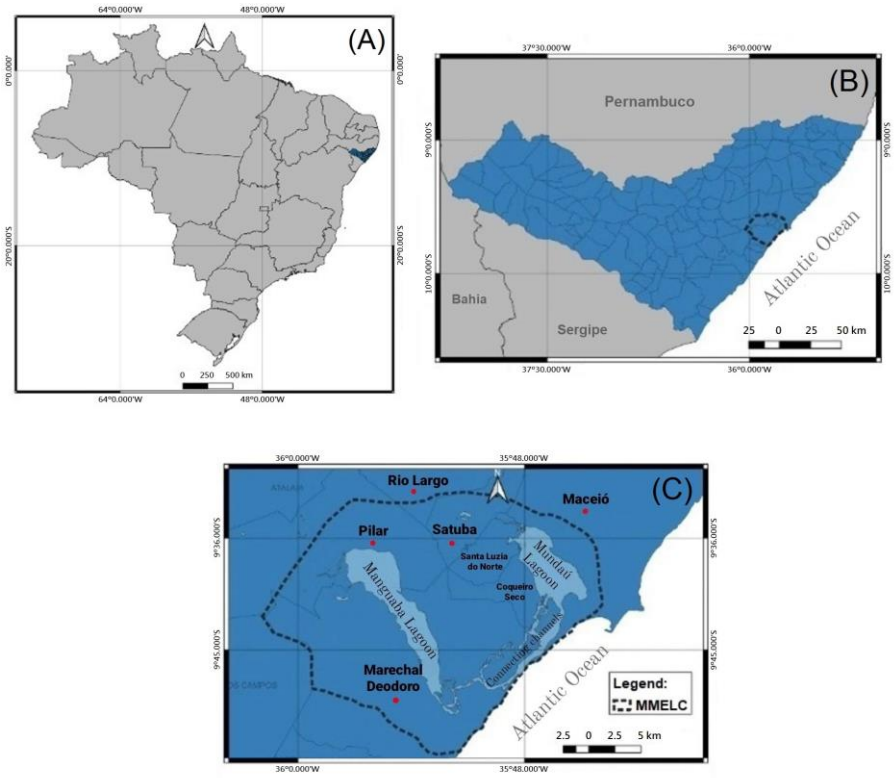

Figure 1 - Location of the study area. (A) Identification on the map of Brazil, (B) in the state of Alagoas and (C) in the Mundaú-Manguaba Estuarine-Lagoon Complex (MMELC), highlighting the municipalities whose street markets were visited. Source: Authors.

The markets were visited twice, from December 18 to 20, 2020, and from May 27 to 30, 2021 (Chart 1), in order to compare the conditions found in the dry and rainy seasons, respectively. Except for the street market of Marechal Deodoro, which begins in the late afternoon, all markets were visited in the morning (Figure 2).

Chart 1 - Schedule of visits to the street markets of the municipalities around the MMELC.

Period	Dry			Rainy			
Date / Market	12/18/2020 (Friday)	12/19/2020 (Saturday)	12/20/2020 (Sunday)	05/27/2021 (Thursday)	05/28/2021 (Friday)	05/29/2021 (Saturday)	05/30/2021 (Sunday)
Maceió	x			x			
Marechal Deodoro	x				x		
Pilar		x				x	
Satuba			x				x
Rio Largo			x				x

Source: Authors.

Figure 2 - Street markets of Maceió, Marechal Deodoro, Pilar, Rio Largo and Satuba where sururu (*Mytella falcata*) vendors work. Source: Authors.

The street markets were classified as to their compliance with the recommendations contained in RDC No. 216/2004 – ANVISA, using an adapted checklist, which included, among others, items belonging to the following categories: 1) physical and hygienic conditions of the facilities, equipment and utensils used; 2) handling and form of display of the product; 3) clothing and use of personal protective equipment; and 4) waste disposal. For each item observed, an answer (YES, NO or DOES NOT APPLY) regarding compliance was assigned, with all items having the same weight. At the end of this stage, calculations were made to classify the street markets into groups: Group 1 comprised street markets that had 76 to 100% of the items within the desired standard (satisfactory); Group 2 comprised street markets that reached 51 to 75% compliance (median); and Group 3 comprised street markets that only met 0 to 50% of the recommendations (unsatisfactory), according to the methodology adopted by Silva Junior; Ferreira and Frazão (2017).

It is worth pointing out that not all the recommendations contained in the resolution are applicable to this type of trade, since the street markets are commonly formed by stalls with tubular metal structures or pieces of wood, covered by tarpaulin or similar material, different from conventional food selling establishments such as supermarkets, bakeries and snack bars, which are often subject to health inspection by the supervisory bodies. Although the street markets are not in its scope of application, RDC No. 216/2004 – ANVISA presents itself as the legal device that best guides the conduct of work involving the evaluation of food marketing environments, as it defines parameters that minimize the risk to the health of consumers, regardless of the type of place of purchase.

In order to carry out a socioeconomic diagnosis of the vendors and general issues of sururu marketing, a semi-structured questionnaire was created to conduct interviews with the vendors. In order not to harm the sales dynamics, sururu vendors were approached when there were no customers in their stalls and, before starting each interview, the researchers introduced themselves and presented the study proposal, also informing about the destination of the data. In addition, the Free and Informed Consent Form (FICF) was read and signed by all participants, who received a duplicate of the document, with the purpose of clarifying possible doubts. All steps of the study were approved by the Ethics Committee of the Federal Institute of Alagoas (nº 55369821.1.0000.0195).

The data obtained on the structural issues of the street markets and the variables related to sururu handling by the vendors were compared between them. Thus, each street market represented a treatment and each interviewee, a repetition. All the points of sururu sale found in the street markets were part of this study, totaling 13 stalls in the first round of visits and 19 in the second round of visits, when all sururu vendors of the first round were interviewed again. Thus, the sample size (number of vendors observed) corresponds to the number of sururu vendors in each street market who collaborated with the research. In the first period of investigation, the sample size in each street market corresponded to the following distribution: Maceió – 2, Marechal Deodoro – 2, Pilar – 3, Satuba – 1 and Rio Largo – 5. In the second period, the distribution was: Maceió – 6, Marechal Deodoro – 2, Pilar – 4, Satuba – 2 and Rio Largo – 5.

For the analysis of mineral composition, at least 200 g of sururu were acquired from each point of sale, totaling 33 samples, distributed as follows: Maceió – 3, Marechal Deodoro – 2, Pilar – 3, Satuba – 1 and Rio Largo – 5, in the dry season, and Maceió – 6, Marechal Deodoro – 2, Pilar – 4, Satuba – 2 and Rio Largo – 5, in the rainy season. The samples were placed in sterile containers, put into a thermal box containing ice, and then kept frozen at approximately -20°C until they were subjected to the laboratory procedures. The extracts were then obtained by acid digestion for analysis of the composition of iron (Fe), copper (Cu), manganese (Mn) and zinc (Zn), using the atomic absorption spectrophotometry technique. Reading of the extracts for investigating the presence of lead (Pb) was performed by following the 3500-Pb protocol of the Standard Methods for the Examination of Water and Wastewater (SMEWW) (LIPPS; BAXTER;

BRAUN-HOWLAND, 2018).

The statistical procedures applied consisted of an analysis of totals and percentages, using descriptive statistics for variables related to the structural issues of the street markets and sururu handling by vendors, and using means and standard deviation to express the concentrations of the minerals investigated, such as Tamano et al. (2020).

3. RESULTS

The street markets of the five municipalities visited are characterized by the marketing of the most diverse foods, household items and articles of clothing. In all of them, it was possible to observe segmentations, not always with physical delimitations, according to the type of product for sale. For instance, there were areas reserved for: meat and fish; fruits, vegetables and legumes; non-perishable foods and spices; non-food products, among others.

The aspect that most differentiated the marketing of sururu among the street markets visited was the structure of the stalls. In Marechal Deodoro, Pilar and Satuba, vendors are arranged in simple wooden or metal structures, almost always covered by tarpaulin. In Maceió and Rio Largo, seafood sale is concentrated in concrete stalls, located in spaces characterized as municipal public markets, with permanent cover, more efficiently protecting the food from exposure to sunlight (Figure 3).

Figure 3 - Structure of the points of seafood marketing in the street markets of (A) Maceió, (B) Marechal Deodoro, (C) Pilar, (D) Rio Largo and (E) Satuba. Source: Authors.

In the first round of visits to the street markets (December/2020), 13 points of sururu sale were observed. In the second round of visits (May/2021), the total was 19, corresponding to the same points previously observed, plus six new ones, according to the distribution shown in Figure 4. It is worth mentioning that, in all these points, sururu is marketed with other types of seafood, mainly fish, shrimp and massunim (*Anomalocardia flexuosa*).

Figure 4 - Total of sururu (*Mytella falcata*) vendors per street market, in the two stages of visitation (December/2020 and May/2021). Source: Authors.

The largest number of points of sale was observed in Maceió (6), followed by Rio Largo (5) and Pilar (4). The representativeness of each street market relative to the total points evaluated in this study is presented in Table 1.

Table 1 - Percentage of points of sururu (*Mytella falcata*) sale of each street market relative to the total number of points evaluated.

Street markets	Points of sururu sale evaluated			
	n_1	%	n_2	%
Maceió	2	15.4	6	31.6
Marechal Deodoro	2	15.4	2	10.5
Pilar	3	23.1	4	21.1
Rio Largo	5	38.5	5	26.3
Satuba	1	7.6	2	10.5
Total	13	100	19	100

Legend: n_1 corresponds to the number of sururu vendors found in the first round of visits and n_2, to the number of sururu vendors found in the second round of visits. Source: Authors.

After applying the checklist to evaluate the hygienic-sanitary conditions of all points of sururu sale, it was possible to classify all the street markets visited as belonging to Group 3 (unsatisfactory), that is, a group of street markets that meet up to 50% of the recommendations regarding the physical and hygienic conditions of the facilities, equipment and utensils used, handling and form of display of the product, clothing and use of personal protective equipment, and waste disposal, regardless of the period in which they were evaluated (Figure 5).

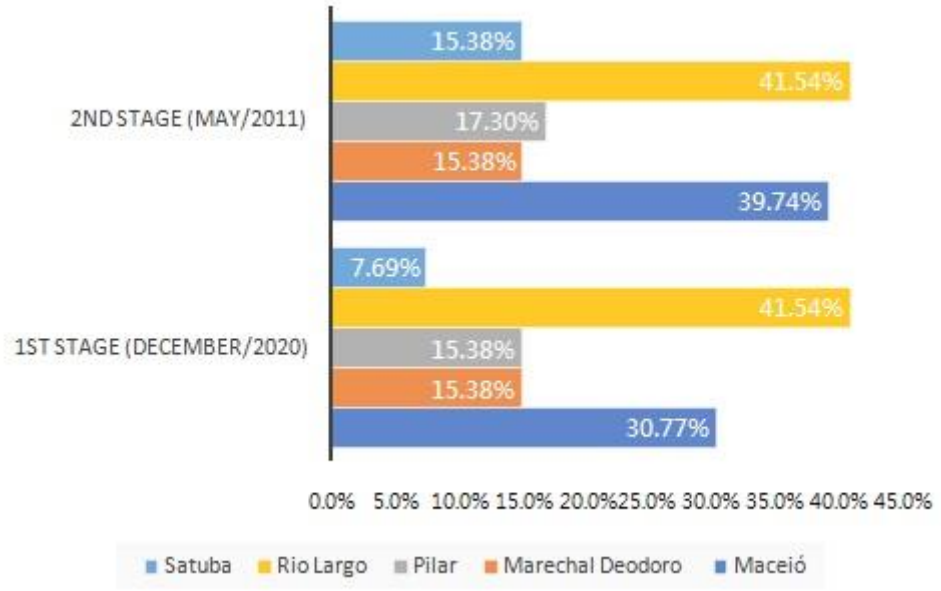

Figure 5 - Percentage of compliance observed in each street market in the two stages of the field study (December/2020 and May/2021). Source: Authors.

The street market of Rio Largo was the one that met the highest number of requirements (41.54%) in both rounds of visit, standing out in the items related to the use of uniform compatible with the activity (preserved and clean) and personal cleanliness, since there was no exception among its vendors. Conversely, the street market of Satuba was the one that least met the minimum criteria required (7.69%) in the first round of observations, showing an improvement in the second round (15.38%), equaling that of Marechal Deodoro, which kept its percentage (15.38%), and that of Pilar, only in the first visit (15.38%) as there was a slight increase in the second visit (17.30%). The greatest positive difference was observed in the street market of Maceió, since the compliance levels increased from 30.77% to 39.74%.

Although the street markets of Maceió, Pilar and Satuba were considered unsatisfactory regarding hygienic-sanitary practices, it is worth pointing out that the increase in their percentage of compliance coincided with the inclusion of vendors with greater care in their work routine. That is, the vendors who were present only in the second round of visits were more careful than those who already traded in those places from the first round of visits.

Unanimously non-conforming aspects refer to the absence of: 1) washbasins in hygienic conditions, equipped with odorless antiseptic liquid soap and hygienic and safe hand-drying system; 2) waste collectors equipped with a lid and operated without manual contact; 3) temperature control for displayed foods; 4) properly identified and functional containers for waste collection of easy cleaning and transport, in sufficient number and capacity to contain the waste; and 5) waste kept in a closed container isolated from food preparation and storage areas (Figure 6).

Figure 6 - Irregularities observed: (A) washbasin occupied by foreign objects, making its proper use impossible, (B) waste collector without a lid and (C and D) waste in an open environment and close to food. Source: Authors.

Other irregularities observed in at least one of the points of all street markets include the presence of objects foreign to the internal and external environments, as well as animals (dogs, mainly), non-use of disposable gloves, and handlers who talk unnecessarily, eat, and handle money during their activities, which may lead to food contamination (Figure 7).

Figure 7 - Irregularities observed regarding (A) handling of money and food by the same person, (B) presence of animal at points of sale and (C) vendors eating near the food for sale. Source: Authors.

As shown in Table 2, most participants were female (84.2%), had incomplete primary education (52.6%), lived in Maceió (42.1%) and declared a monthly income of one minimum wage (52.6%). For 68.4% of the vendors, seafood marketing was their only source of income. For the remaining 31.6%, the monthly income was complemented by works as artisans, shellfish gatherers, fishermen, tapioca flatbread sellers and resellers of other foodstuffs.

The largest number of vendors were within the age group that ranged from 43 to 51 years (31.6%), and the most frequent answer regarding the time of experience in the field was 29 to 35 years (31.6%). In relation to the cost to maintain the point of sale in the street markets, the majority (36.8%) stated that they paid R$10.00 per week to the respective municipal secretariats that manage the spaces.

Table 2 - General characterization of sururu (*Mytella falcata*) vendors of the street markets of the municipalities surrounding the Mundaú-Manguaba Estuarine-Lagoon Complex (MMELC) – sample size(n) = 19.

Aspects	Answers	n	%
Gender	Female	16	84.2
	Male	3	15.8
Age	25 - 33	2	10.5
	34 - 42	5	26.3
	43 - 51	6	31.6
	52 - 60	5	26.3
	61 - 69	1	5.3
Education Level	Incomplete primary education	10	52.6
	Complete primary education	4	21.1
	Incomplete secondary education	2	10.5
	Complete secondary education	2	10.5
	No education	1	5.3
Municipality of residence	Coqueiro Seco	2	10.5
	Maceió	8	42.1
	Marechal Deodoro	1	5.3
	Pilar	2	10.5
	Rio Largo	5	26.3
	Santa Luzia do Norte	1	5.3
How long have you been selling sururu in the street market?	1 - 7	5	26.3
	8 - 14	2	10.5
	15 - 21	3	15.8
	22 - 28	3	15.8
	29 - 35	6	31.6
Do you have another profession or income?	Yes	6	31.6
	No	13	68.4
What is your family income?	Less than one minimum wage – below R$ 1,100.00	6	31.6
	One minimum wage – R$1,100.00	10	52.6
	Two to three minimum wages – from R$ 2,200.00 to R$ 3,300.00	3	15.8
How much do you pay (per week) to sell in the street market (tax/fee)?	Nothing	6	31.6
	R$2.00	1	5.3
	R$5.00	2	10.5
	R$7.00	2	10.5
	R$10.00	7	36.8
	R$12.50	1	5.3

Source: Authors.

The answers obtained during the interviews based on the second section of the questionnaire, presented in Table 3, showed that slightly more than half of the vendors (52.6%) buy sururu from middlemen. Most of the sururu sold during the visiting periods for the present

study came from the municipality of Coqueiro Seco (36.8%), and the distance from the collection site to the street market where it is sold does not exceed 30 km for 78.9% of the cases. The times for receiving the mollusk are the most varied, from the first two hours of the day to 21h00, with none of the times standing out. All vendors reported that the volume purchased is stored in polystyrene boxes with ice during transportation, which is carried out by car (almost always chartered). Once received, the sururu is kept on ice by most vendors (57.9%), while the others (42.1%) freeze it in a freezer.

In the street markets, sururu can be found in polystyrene boxes with ice (15.8%), in plastic packaging, in defined portions of 0.5 kg or 1.0 kg, and surrounded by ice (26.3%) or frozen (10.5%). However, it is more commonly displayed within aluminum basins with ice (47.4%).

Table 3 - Origin, transport and storage of sururu (*Mytella falcata*) sold in the street markets of Maceió (n=6), Marechal Deodoro (n=2), Pilar (n=4), Satuba (n=2) and Rio Largo (n=5).

Aspects	Markets	Answers	n	% market	% total (n=19)
From whom do you buy sururu?	Maceió	Directly from fisherman	4	66.66	21.08
		From middleman	1	16.67	5.27
		Does not buy, collect it	1	16.67	5.27
	Marechal Deodoro	Directly from fisherman	2	100.00	10.50
		From middleman	0	0.00	0.00
		Does not buy, collect it	0	0.00	0.00
	Pilar	Directly from fisherman	2	50.00	10.55
		From middleman	2	50.00	10.55
		Does not buy, collect it	0	0.00	0.00
	Satuba	Directly from fisherman	0	0.00	0.00
		From middleman	2	100.00	10.50
		Does not buy, collect it	0	0.00	0.00
	Rio Largo	Directly from fisherman	1	20.00	5.26
		From middleman	4	80.00	21.04
		Does not buy, collect it	0	0.00	0.00
Sururu place of origin	Maceió	Maceió	3	50.00	15.80
		Coqueiro Seco	2	33.33	10.54
		Roteiro	0	0.00	0.00
		Santa Luzia do Norte	1	16.67	5.27
	Marechal Deodoro	Maceió	2	100.00	10.50
		Coqueiro Seco	0	0.00	0.00
		Roteiro	0	0.00	0.00
		Santa Luzia do Norte	0	0.00	0.00
	Pilar	Maceió	0	0.00	0.00
		Coqueiro Seco	4	100.00	21.10
		Roteiro	0	0.00	0.00
		Santa Luzia do Norte	0	0.00	0.00
	Satuba	Maceió	0	0.00	0.00
		Coqueiro Seco	1	50.00	5.25
		Roteiro	0	0.00	0.00
		Santa Luzia do Norte	1	50.00	5.25
	Rio Largo	Maceió	0	0.00	0.00
		Coqueiro Seco	1	20.00	5.26
		Roteiro	2	40.00	10.52
		Santa Luzia do Norte	2	40.00	10.52
Distance from collection	Maceió	5.0 - 25.0	6	100.00	31.60
		26.0 - 56.0	0	0.00	0.00
		57.0 - 77.0	0	0.00	0.00

site to the market (km)		78.0 - 98.0	0	0.00	0.00
		5.0 - 25.0	0	0.00	0.00
	Marechal Deodoro	26.0 - 56.0	2	100.00	10.50
		57.0 - 77.0	0	0.00	0.00
		78.0 - 98.0	0	0.00	0.00
		5.0 - 25.0	4	100.00	21.10
	Pilar	26.0 - 56.0	0	0.00	0.00
		57.0 - 77.0	0	0.00	0.00
		78.0 - 98.0	0	0.00	0.00
		5.0 - 25.0	2	100.00	10.50
	Satuba	26.0 - 56.0	0	0.00	0.00
		57.0 - 77.0	0	0.00	0.00
		78.0 - 98.0	0	0.00	0.00
		5.0 - 25.0	0	0.00	0.00
	Rio Largo	26.0 - 56.0	3	60.00	15.78
		57.0 - 77.0	0	0.00	0.00
		78.0 - 98.0	2	40.00	10.52
At what time did you receive the sururu?	Maceió	2:00 - 6:00	2	33.33	10.54
		7:00 - 11:00	0	0.00	0.00
		12:00 - 16:00	2	33.33	10.54
		17:00 - 21:00	2	33.33	10.54
	Marechal Deodoro	2:00 - 6:00	0	0.00	0.00
		7:00 - 11:00	1	50.00	5.25
		12:00 - 16:00	0	0.00	0.00
		17:00 - 21:00	1	50.00	5.25
	Pilar	2:00 - 6:00	1	25.00	5.27
		7:00 - 11:00	0	0.00	0.00
		12:00 - 16:00	1	25.00	5.27
		17:00 - 21:00	2	50.00	10.55
	Satuba	2:00 - 6:00	0	0.00	0.00
		7:00 - 11:00	0	0.00	0.00
		12:00 - 16:00	2	100.00	10.50
		17:00 - 21:00	0	0.00	0.00
	Rio Largo	2:00 - 6:00	0	0.00	0.00
		7:00 - 11:00	4	80.00	21.04
		12:00 - 16:00	0	0.00	0.00
		17:00 - 21:00	1	20.00	5.26
How was the sururu transported to the market?	Maceió	By car, in polystyrene box with ice	6	100.00	31.60
	Marechal Deodoro		2	100.00	10.50
	Pilar		4	100.00	21.10
	Satuba		2	100.00	10.50
	Rio Largo		5	100.00	26.30
How was the sururu stored?	Maceió	Frozen in freezer	3	50.00	15.80
		On ice	3	50.00	15.80
	Marechal Deodoro	Frozen in freezer	0	0.00	0.00
		On ice	2	100.00	10.50
	Pilar	Frozen in freezer	2	50.00	10.55
		On ice	2	50.00	10.55
	Satuba	Frozen in freezer	1	50.00	5.25
		On ice	1	50.00	5.25
	Rio Largo	Frozen in freezer	2	40.00	10.52
		On ice	3	60.00	15.78
How is the	Maceió	Unpackaged, in aluminum basins with ice	5	83.33	26.33

sururu kept in the market?		Unpackaged, in polystyrene boxes with ice	0	0.00	0.00
		Packaged in portions, surrounded by ice	1	16.67	5.27
		Packaged in portions, frozen	0	0.00	0.00
	Marechal Deodoro	Unpackaged, in aluminum basins with ice	1	50.00	5.25
		Unpackaged, in polystyrene boxes with ice	1	50.00	5.25
		Packaged in portions, surrounded by ice	0	0.00	0.00
		Packaged in portions, frozen	0	0.00	0.00
	Pilar	Unpackaged, in aluminum basins with ice	0	0.00	0.00
		Unpackaged, in polystyrene boxes with ice	1	25.00	5.28
		Packaged in portions, surrounded by ice	2	50.00	10.55
		Packaged in portions, frozen	1	25.00	5.28
	Satuba	Unpackaged, in aluminum basins with ice	0	0.00	0.00
		Unpackaged, in polystyrene boxes with ice	0	0.00	0.00
		Packaged in portions, surrounded by ice	1	50.00	5.25
		Packaged in portions, frozen	1	50.00	5.25
	Rio Largo	Unpackaged, in aluminum basins with ice	3	60.00	15.78
		Unpackaged, in polystyrene boxes with ice	1	20.00	5.26
		Packaged in portions, surrounded by ice	0	0.00	0.00
		Packaged in portions, frozen	1	20.00	5.26

Source: Authors.

The interviewees were also asked about the hygiene practices they consider important when performing their activities. All the care measures mentioned by them, as well as the frequency of mentions, can be seen in Figure 8. For this question, the interviewees were allowed to mark more than one answer, and the percentages were calculated according to the total of answers obtained for each question, which exceed the total of respondents (n = 19).

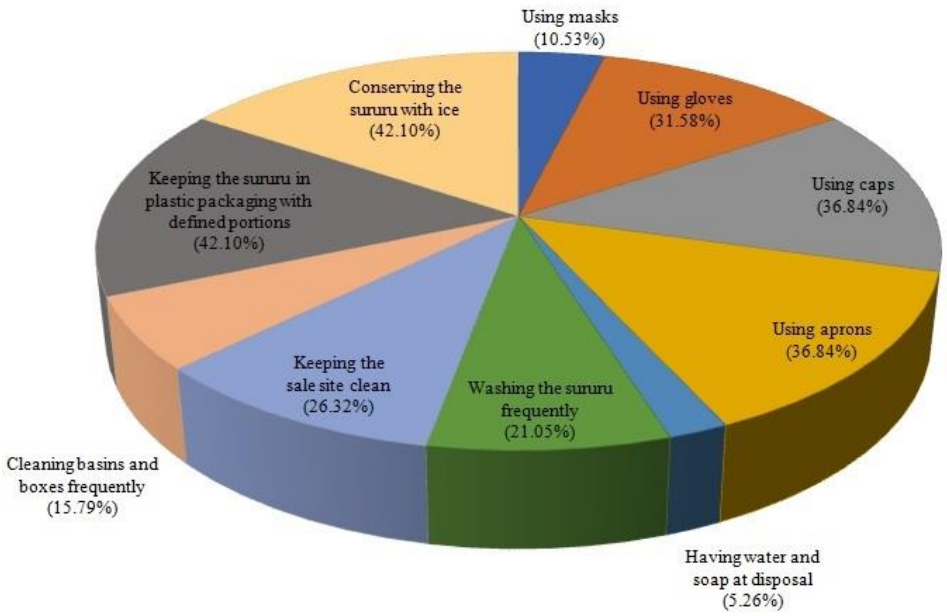

Figure 8 - Hygiene practices considered important by sururu (*Mytella falcata*) vendors of the street markets of Maceió (n=6), Marechal Deodoro (n=2), Pilar (n=4), Satuba (n=2) and Rio Largo (n=5). Source: Authors.
The interviewees were allowed to mark more than one answer, and the percentages were calculated according to the total number of answers obtained for each question, which exceed the total number of respondents (n = 19).

Although not all of the practices mentioned were found during the visits to the street markets, or were, but less frequently than indicated, the mere mention of them reflects the awareness of some vendors in relation to what should be done to mitigate the risks to food safety, even if it is not done. An example of this is the practice of keeping the sururu in plastic

packaging with defined portions, cited by eight interviewees, but which, in reality, was only practiced by five vendors (Table 3).

Since the two rounds of visitation to the street markets occurred during the phase of restrictions due to the Covid-19 pandemic, it was not possible to measure how the recommendations of the World Health Organization regarding care to prevent infection by the virus, such as the use of masks and frequent hand hygiene with 70% alcohol, influenced the conduct of the vendors, as it could not be compared with the pre-pandemic behavior. Still, the only measures adopted in some street markets were: alcohol bottle available at the entrance of the marketing spaces – in Marechal Deodoro, liquid alcohol was sprayed on the hands of those who entered, and in Rio Largo, there was a foot-operated gel alcohol dispenser (Figure 9A); and the use of masks by some vendors, almost always inappropriately – hanging by one of the ear loops or below the chin (Figure 9B).

Figure 9 - Measures adopted in the street markets of the municipalities surrounding the MMELC to prevent the spread of the coronavirus: (A) installation of a foot-operated gel alcohol dispenser in the street market of Rio Largo and (B) (inappropriate) use of mask. Source: Authors.

According to the testimonies of the vendors about the changes caused by the pandemic in their work routine, the impact on sales was undoubtedly the most significant. Although the street markets were included in the list of essential activities, with no control over the movement of customers, the fear of the population to leave home, especially in the first months of the pandemic, caused financial losses to many sururu vendors, which led some of them to look for alternatives to guarantee or complement their income.

When asked about their participation in any lecture, course or training (Table 4), 13 vendors answered yes (68.4%), they had already participated in course(s) on good food handling practices, promoted by the Sanitary Surveillance (Maceió and Rio Largo), the Commercial Association of Maceió, the Colony of Fishermen of Coqueiro Seco and the Fishing Center of

Jaraguá (Maceió), between the years 2017 and 2021. Regarding the interest in participating again, or for the first time, 11 answered positively.

Table 4 - Participation and interest of sururu (*Mytella falcata*) vendors of the street markets of Maceió (n=6), Marechal Deodoro (n=2), Pilar (n=4), Satuba (n=2) and Rio Largo (n=5) in training courses on good food handling practices.

Aspects	Markets	Answers	n	% market	% total (n=19)
Have you ever participated in any lecture, course or training on good food handling practices?	Maceió	Yes	5	83.33	26.33
		No	1	16.67	5.27
	Marechal Deodoro	Yes	1	50.00	5.25
		No	1	50.00	5.25
	Pilar	Yes	2	50.00	10.55
		No	2	50.00	10.55
	Satuba	Yes	0	0.00	0.00
		No	2	100.00	10.50
	Rio Largo	Yes	5	100.00	26.30
		No	0	0.00	0.00
Are you interested in participating in (other) training programs?	Maceió	Yes	3	50.00	15.80
		No	3	50.00	15.80
	Marechal Deodoro	Yes	1	50.00	5.25
		No	1	50.00	5.25
	Pilar	Yes	3	75.00	15.84
		No	1	25.00	5.27
	Satuba	Yes	1	50.00	5.25
		No	1	50.00	5.25
	Rio Largo	Yes	3	60.00	15.78
		No	2	40.00	10.52

Source: Authors.

The concentrations of the minerals studied are presented in Table 5. Iron was the mineral which had the most significant values, with the highest mean (8.386 mg/kg) detected among the samples collected in the street market of Pilar and the lowest mean (2.724 mg/kg) in those collected in the street market of Marechal Deodoro, both in the dry season. Copper had the highest mean concentration (0.111 mg/kg) in sururu from the street market of the capital, with minimum value (0.017 mg/kg) in samples from the street market of Satuba, also in the dry season for both cases. Regarding manganese, both the highest (0.253 mg/kg) and the lowest (0.144 mg/kg) mean values were identified in the samples from the street market of Pilar, obtained in the dry and rainy seasons, respectively. For zinc, the highest mean (0.461 mg/kg) was observed in the samples collected in Marechal Deodoro and the lowest mean (0.245 mg/kg) was found in sururu marketed in Satuba, relative to mollusks obtained in the dry season. Regarding lead, the samples collected in the street markets of Pilar had the highest values (0.015 mg/kg) in the rainy season, while in Marechal Deodoro, Satuba and Rio Largo the lowest concentration (0.005 mg/kg) was found in the dry season.

Table 5 - Concentrations of iron (Fe), copper (Cu), manganese (Mn), zinc (Zn) and lead (Pb) minerals in sururu (*Mytella falcata*) acquired in the street markets around the Mundaú and Manguaba lagoons, AL, Brazil.

	Municipalities					Means
Minerals (mg/kg)	Maceió	Marechal Deodoro	Pilar	Satuba	Rio Largo	
Fe_A	2.931 ± 1.047	2.724 ± 2.778	8.386 ± 2.181	4.901 ± *	6.611 ± 3.281	5.111 ± 2.322
Fe_B	4.049 ± 1.111	5.879 ± 1.561	6.054 ± 0.858	7.002 ± 1.934	5.027 ± 2.179	5.602 ± 1.529
Fe_{OM}	3.676 ± 1.166	4.302 ± 2.589	7.053 ± 1.873	6.301 ± 1.828	5.819 ± 2.755	5.430 ± 2.042
Cu_A	0.111 ± 0.073	0.103 ± 0.003	0.044 ± 0.033	0.017 ± *	0.061 ± 0.031	0.067 ± 0.035
Cu_B	0.095 ± 0.060	0.048 ± 0.004	0.067 ± 0.039	0.051 ± 0.058	0.102 ± 0.053	0.073 ± 0.043
Cu_{OM}	0.100 ± 0.061	0.076 ± 0.032	0.057 ± 0	0.040 ± 0.045	0.081 ± 0.046	0.071 ± 0.044
Mn_A	0.224 ± 0.089	0.198 ± 0.124	0.253 ± 0.052	0.243 ± *	0.246 ± 0.041	0.233 ± 0.076
Mn_B	0.207 ± 0.069	0.214 ± 0.008	0.144 ± 0.036	0.163 ± 0	0.179 ± 0.023	0.181 ± 0.027
Mn_{OM}	0.212 ± 0.071	0.206 ± 0.072	0.190 ± 0.070	0.190 ± 0.046	0.212 ± 0.047	0.202 ± 0.061
Zn_A	0.363 ± 0.090	0.461 ± 0.194	0.323 ± 0.033	0.245 ± *	0.295 ± 0.070	0.337 ± 0.097
Zn_B	0.376 ± 0.062	0.320 ± 0.003	0.329 ± 0.112	0.346 ± 0.052	0.352 ± 0.048	0.345 ± 0.055
Zn_{OM}	0.372 ± 0.067	0.390 ± 0.138	0.326 ± 0	0.312 ± 0.069	0.324 ± 0.064	0.345 ± 0.084
Pb_A	0.009 ± 0.008	0.005 ± 0	0.008 ± 0.006	0.005 ± *	0.005 ± 0	0.007 ± 0.003
Pb_B	0.013 ± 0.005	0.011 ± 0.002	0.015 ± 0.007	0.011 ± 0.002	0.007 ± 0.004	0.011 ± 0.004
Pb_{OM}	0.012 ± 0.006	0.008 ± 0.003	0.012 ± 0.007	0.009 ± 0.004	0.006 ± 0.003	0.009 ± 0.005

Legend: Mean ± standard deviation of 33 samples analyzed. Number of samples per street market: Maceió – 3, Marechal Deodoro – 2, Pilar – 3, Satuba – 1 and Rio Largo – 5, in the dry season (A), and Maceió – 6, Marechal Deodoro – 2, Pilar – 4, Satuba – 2 and Rio Largo – 5, in the rainy season (B). OM: overall mean. *Single sample. Source: Authors.

4. DISCUSSION

The field research carried out in two stages allowed identifying a difference in the number of sururu vendors, which was lower in the first round of visits (dry season). When asked about the number of sururu vendors found in the first round, the vendors present reported that some colleagues were isolated in their homes due to the pandemic caused by the coronavirus, while others had given up the activity or were selling different products, since they had been facing difficulties in acquiring the mollusk, because of the low production in Alagoas.

This shortage reported by the interviewed vendors is considered atypical in the dry season. In the winter period, this scenario of low availability of the mollusk is common, especially after periods of rain, when the salinity of the lagoons is below the ideal for sururu survival and development (SILVA; SOUSA; KAYANO, 2007). Some vendors even admitted to occasionally resorting to the purchase of sururu from other states, such as Bahia and Pernambuco. Such difficulty in the period of greater demand for sururu, mainly by establishments related to tourism, resulted in an increase in the value passed on to consumers, which ranged from R$18.00 to R$25.00 per kilogram. In the rainy season, although the resource is not yet found in satisfactory quantity, some vendors returned and the prices dropped, ranging from R$ 10.00 to R$ 16.00 per kilogram.

While studies indicate that sururu collection is mostly carried out by men (TAMANO et al., 2015), its marketing in the street markets visited was predominantly led by women. Most of the vendors (63.2%) live in the municipality where they sell the sururu. The factors that motivate the displacement of 36.8% of the vendors to another city include the identification with the place, availability of points of sale and the absence of street markets in their municipalities of

residence, as in the cases of Coqueiro Seco and Santa Luzia do Norte. The education level and income reported by most of the interviewees did not differ significantly from those found by Tamano et al. (2015). Although the largest number of vendors was found within the range of 43 to 51 years, the second highest frequency was within the ranges of 34 to 42 and 52 to 60 years, and it is common to find young people under the age of 30 and vendors over 60 years.

Of all the vendors interviewed, only one declared to be responsible for catching the sururu that he sells, explaining that the activity represents a family tradition. The others reported that the mollusks are directly purchased from fishermen (42.1%) or middlemen (52.6%). Although the value paid to fishermen is lower, purchasing sururu from the middleman is more advantageous due to the convenience of receiving the product already in the city where it will be sold, avoiding additional costs with transportation. Most of the sururu sold came from the municipality of Coqueiro Seco, more specifically from the Cadoz village.

Considering the results obtained with the application of the checklist, it was found that the markets with the two highest percentages of compliance with the recommendations of RDC No. 216/2004 were those in which the vendors are allocated in concrete stalls, that is, the markets of Rio Largo and Maceió. Souza and Pontes (2020) suggest that, with such structures, workers feel more encouraged to maintain a healthy environment, especially if the spaces have recently undergone structural improvements. Despite that, these street markets did not even reach the classification of median, following the methodology proposed by Silva Junior; Ferreira and Frazão (2017).

Among the irregularities verified, something that draws the attention is the absence in all street markets of essential items for maintaining an environment consistent with the marketing of food, such as: washbasins for adequate asepsis of handlers' hands, and sufficient number of waste collectors with pedal-operated lid in order to avoid the accumulation of discarded material in areas of circulation of people. The conditions found also show the need for greater care to control the access of animals and review the behaviors of eating and unnecessarily talking near the food for sale, as well as the practice of handling money and seafood by the same person, since only three vendors had assistants to receive payments. Similar circumstances have been diagnosed in street markets in all regions of the country (CAPISTRANO; GERMANO; GERMANO, 2004; SILVA; MATTÉ; MATTÉ, 2008; MACHADO et al., 2010; ALMEIDA; PENA, 2011; VARGAS; PEROTTO; CARDOSO, 2016; SILVA JUNIOR; FERREIRA; FRAZÃO, 2017).

Although the attitude of the vendors has been the most emphasized in this study, the answers presented in Figure 8 make it possible to affirm that the reality would be more consistent with the expectation if there were a greater effort on the part of city halls to provide the necessary equipment to ensure a safer marketing environment, both for the food and for those who sell it.

Although the vendors have not been questioned as to the origin of the ice used to preserve sururu in the places of sale, one cannot fail to mention the relevance of this factor regarding the safety of foods marketed under this condition. Research conducted in street markets in Brazil points to ice as one of the sources of contamination of seafood (GIAMPIETRO; REZENDE-LAGO, 2009; FERREIRA; CALIL; SILVA, 2013; FERREIRA et al., 2014; PENHA et al., 2020; ALMEIDA; MORALES, 2021), since, after being subjected to analyses, it did not meet the parameters recommended in Annex XX of Ordinance No. 5, of September 28, 2017, of the Ministry of Health, which consolidates the rules about actions and health services of the Unified Health System (BRASIL, 2017).

In addition to the structural aspects, the best performance of the street market of Rio Largo seems to be related to the participation of the vendors in the course on good food handling practices, promoted by the city hall. Participation in the course was a mandatory requirement in the registration of vendors for using, with exemption from fees, the concrete stalls in the space that was inaugurated in 2018, after years of demand by the vendors themselves for a cleaner and

more organized environment, which were also safer in case of flooding by the Mundaú River, such as the one that occurred in 2010, which flooded the entire region of trade (SOUZA et al., 2020).

The relationship between the results and the participation in the course becomes even more plausible considering studies such as that of Winter et al. (2015), who compared the compliance levels before and after training in an institutional reception unit. In the first application of the checklist, the overall compliance level was 39%. In the second, post-training, the percentage increased to 93%. The authors highlighted changes in the improvement of techniques and proper handling of food, as well as in the behavior and awareness of handlers for implementing GHP in the establishment. Also in this context, Sangioni et al. (2019) reinforce the need for encouragement and periodic provision of specialized courses for food handlers.

Among the minerals analyzed, iron is present at higher concentration in sururu. Even the sample with the lowest concentration in the five municipalities (2.724 mg/kg) still has iron as the predominant mineral. Despite that, these concentrations were lower than those found in other studies (RAMOS, 2011; SANTOS et al., 2014; SANTOS; BOEHS, 2021). The values obtained in this study were closer to those presented by Santos et al. (2014), whose samples came from the same estuarine-lagoon complex, whereas Ramos (2011) analyzed the concentration of iron in sururu collected in the Formoso River, in Pernambuco, and Santos and Boehs (2021) collected their samples in four mangroves of the southern coast of Bahia.

Given the importance of iron as a component of several proteins, including enzymes and hemoglobin, the inclusion of sururu in the diet along with other foods that are also sources of the mineral, such as beans, beets and kale, contributes to reaching the amount of iron that should be ingested daily (14 mg) (BRASIL, 2005).

Contrary to what could be expected from the statement made by Gil and Gil (2015), that copper is as abundant in mollusks as iron, the means obtained in this study did not exceed 0.111 mg/kg, with this micromineral being the one at lowest concentration in all the samples analyzed. The same could be observed among the sururu samples analyzed by Santos and Boehs (2021), who also had the lowest means of copper.

Although related to the contamination of natural environments for being potentially toxic (YADA; MELO; MELO, 2020), copper is essential because it is incorporated into several structural and enzymatic proteins involved in cell respiration, defense against free radicals, neurotransmission, connective tissue synthesis and cellular metabolism of iron (AN et al., 2022).

The mean concentrations of manganese showed little variation, being lower than those found by other authors (RAMOS, 2011; SANTOS; BOEHS, 2021). According to Pereira et al. (2009), the importance of manganese is due to its function of activating enzymes in various physiological processes, as it is well distributed throughout the body. However, when in excess, this micromineral can be a neurotoxic agent, capable of inhibiting synaptic and neuromuscular transmission and neuromuscular excitation (KRANG; ROSENQVIST, 2006).

Zinc was the second most abundant micromineral in sururu samples in all street markets, although its mean concentrations were lower than those obtained in other studies (RAMOS, 2011; SANTOS et al., 2014; SANTOS; BOEHS, 2021). Considered one of the most important essential mineral elements, zinc acts in the production of protein and genetic material, besides being involved in the perception of taste, in the wound healing processes and in the health of the reproductive and immune systems (GRILLO et al., 2020). In experiments conducted by Santos et al. (2014), zinc was the mineral which had the lowest losses after sururu was cooked.

Coincidentally, the mean concentrations of the microminerals studied here followed the same order indicated regarding the need for daily intake, namely: Fe (14 mg), Zn (7 mg), Mn (2.3 mg) and Cu (0.9 mg) (BRASIL, 2005). In order to establish a relationship between this set of values and their relevance in practice, the quantities of sururu that must be consumed to meet the daily needs of the minerals in question were calculated (Table 6), considering sururu as the

only source of these nutrients. The calculations were performed considering the samples that had the highest mean concentrations of the elements.

Table 6 - Quantity of sururu (*Mytella falcata*) that should be consumed to meet the recommendations of daily intake of the minerals iron (Fe), copper (Cu), manganese (Mn) and zinc (Zn), having as reference the highest mean concentrations of the samples collected in the street markets around the Mundaú and Manguaba lagoons, AL, Brazil.

Minerals	RDI	Quantity of sururu to be consumed*
Fe	14.0 mg	1.7 kg
Zn	7.0 mg	15.2 kg
Mn	2.3 mg	9.1 kg
Cu	0.9 mg	8.1 kg

RDI: Recommended daily intake (BRASIL, 2005).
*Considering the highest values of means.
Source: Authors.

Regarding the investigation of lead in the samples of the present study, the mean concentrations obtained in each street market visited did not exceed 0.012 mg/kg, much lower than the limit allowed (1.5 mg/kg) by the RDC No. 42, of August 29, 2013, of ANVISA, about the MERCOSUR Technical Regulation on Maximum Limits of Inorganic Contaminants in Food (BRASIL, 2013).

As exemplified in the previous table, the quantity of sururu to be consumed was calculated so that the maximum permissible limit of lead is reached (Table 7), considering the highest mean concentration of the metal in the samples.

Table 7 - Quantity of sururu (*Mytella falcata*) to be consumed to reach the maximum limit of lead (Pb) allowed by current legislation, having as reference the highest mean concentration of the metal among the samples collected in the street markets around the Mundaú and Manguaba lagoons, AL, Brazil.

Mineral	MPL	Quantity of sururu to be consumed*
Pb	1.5 mg	125.0 kg

MPL: Maximum permissible limit (BRASIL, 2013).
*Considering the highest value of mean.
Source: Authors.

Although, according to the calculations, it is necessary to ingest 125.0 kg of sururu to reach the maximum limit of lead considered safe for consumers of bivalve mollusks, the bioaccumulation effect of the metal requires careful consumption.

Despite reporting higher means than those of the present study, Santos et al. (2014) analyzed sururu samples from the MMELC in 2009 and also obtained lead concentrations below the limit allowed. In the study conducted by Lima (2012), whose sururu samples were also from the MMELC, in the years 2010 and 2011, the metal was detected at mean concentrations above the maximum limit allowed in three of the five collection points.

It is known that the incorporation of lead by mollusks can vary according to numerous environmental and physiological factors of these invertebrates (HIGINO et al., 2012; SHARIF; CHONG; MENG, 2016), so various reasons could justify the different concentrations of this mineral in the samples analyzed here and in other studies.

It is important to emphasize that the concentrations of metals detected do not necessarily correspond to the conditions of sururu and MMELC in the municipalities where the samples were collected, because the vendors acquire the mollusk from several locations, not only from the lagoon portion located within the city where the street market is established. Thus, the sururu caught in one municipality, depending on the availability of the resource in each season, is marketed in several other cities.

4. CONCLUSIONS

Despite the existence of a technical regulation of good practices for food services, in force in the country since 2004, both the physical facilities of the street markets of the municipalities surrounding the Mundaú-Manguaba Estuarine-Lagoon Complex and the handling of seafood, especially sururu, are far below what is recommended by the National Health Surveillance Agency.

However, it is worth mentioning the initiative of some municipalities that, together with their competent bodies, such as the Municipal Health Surveillance, have been recognizing the need for GHP training and promoting courses to vendors. Based on the findings of this study, taking the courses offered may have positively influenced the conduct of the vendors, since the highest levels of compliance were observed at the points where those responsible were trained.

Therefore, there is a clear need for a greater intervention by the public power in the creation and implementation of actions that improve the spaces intended for food marketing, as well as the periodic promotion of courses on good practices for the vendors, making the street markets places more suitable for the sale of these products.

The results of the analyses regarding the concentrations of minerals in sururu corroborated studies that point to it as an important source of these nutrients, especially iron, although the concentrations detected were lower than those of other studies with the same theme. The detection of lead in all samples, although at low concentrations, requires attention, especially from the competent agencies, which must permanently act in monitoring the conditions of environments such as the MMELC, supervising and curbing improper practices.

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