Quail egg safety and trade on beaches of *Salvador* (BA): A study from a child labor perspective[1]

O comércio e a segurança de ovos de codorna em praias de Salvador *(BA): um estudo na perspectiva do trabalho infantil*

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ABSTRACT

Objective

This study aimed to describe the trade and microbiological quality of boiled quail eggs on the waterfront of *Salvador, Bahia,* Brazil, from the child labor perspective.

Methods

This cross-sectional study administered semi-structured questionnaires to 40 underage vendors and performed the microbiological assessment of 40 quail egg samples as follows: mesophilic aerobic microorganism count, coagulase-positive staphylococcus count, estimation of the most probable number of total and thermotolerant coliforms/*Escherichia coli*, and testing for *Salmonella* spp.. The results were compared with the standards provided by the Resolution RDC n° 12/2001, National Sanitary Surveillance Agency.

Results

The vendors were mostly female (57.5%) students (95.0%) aged 8 to 17 years. The most common reason for working was supplementation of the family income (57.5%). The mean gross income was R$38.31/day. Most of them presented inadequate personal hygiene but they recognized that foods could cause diseases. Many (47.5%) vendors reported washing their hands up to twice daily. Mean mesophilic aerobic microorganism and coagulase-positive staphylococcus counts were 2.43 and 2.01 log colony-forming unit/g, respectively, and the

[1] Article based on the dissertation of PO VIDAL JÚNIOR, intitled "Comida de rua e segurança de alimentos na orla marítima de Salvador-BA: um estudo na perspectiva do trabalho infantil". Universidade Federal da Bahia; 2011.

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estimated thermotolerant coliform contamination was 0.98 log most probable number/g. Escherichia coli was found in 15.0% of the samples and none contained *Salmonella spp.* Most (55.0%) samples were noncompliant with the legislation.

Conclusion

The results evidenced the presence of minors selling quail eggs on beaches of Salvador and suggest risk to consumers' health because of the detected contamination and vendors' ignorance of principles of hygiene.

Indexing terms: Child labor. Eggs. Street food.

RESUMO

Objetivo

Este estudo buscou caracterizar o comércio e a qualidade microbiológica de ovos de codorna cozidos, na orla de Salvador, Bahia, na perspectiva do trabalho infantil.

Métodos

Realizou-se estudo transversal, com aplicação de questionários semi-estruturados, junto a 40 vendedores menores de idade, e análise microbiológica de 40 amostras, submetidas aos procedimentos que seguem: contagem de micro-organismos aeróbios mesófilos, estafilococos coagulase-positiva e estimativa do número mais provável de coliformes totais e termotolerantes/Escherichia coli e pesquisa de Salmonella spp. Os resultados foram comparados com padrões da Resolução RDC n° 12/2001, Agência Nacional de Vigilância Sanitária.

Resultados

Os vendedores eram predominantemente meninas (57,5%), tinham faixa etária entre 8 e 17 anos e estudavam (95.0%). A complementação da renda familiar foi a razão mais apontada para o trabalho (57,5%), sendo a renda média na atividade de R$38,31/dia. A maioria não observava requisitos de higiene pessoal, porém considerou que os alimentos poderiam veicular doenças. Quanto à frequência de lavagem das mãos, a maioria (47,5%) declarou lavá-las até duas vezes/dia. As contagens de micro-organismos aeróbios mesófilos e estafilococos coagulase-positiva registraram valores médios de 2,43 e 2,01 log unidade formadora colônia/g, respectivamente, enquanto a estimativa de termotolerantes foi de 0,98 log número mais provável/g; identificou-se Escherichia coli em 15,0% das amostras e ausência de Salmonella spp. Entre as amostras, 55,0% classificaram-se como não conformes.

Conclusão

Os resultados evidenciam a inclusão de menores de idade no comércio de ovos de codorna, nas praias e sugerem riscos aos consumidores, devido à contaminação registrada e ao desconhecimento dos vendedores quanto aos princípios de higiene.

Termos de indexação: *Trabalho de menores. Ovos. Comida de rua*

INTRODUCTION

Consumption of street food is an old practice that has been growing in the last decades, especially because of socioeconomic changes. This segment offers a diversity of foods and beverages for immediate or later consumption. This type of trade has a high economic potential and its development aims to meet the needs of part of the population who requires fast and cheap meals, preserving food traditions[1-3].

In this scenario, street food trade increases employment and provides income to less fortunate social groups, markedly including people of working age, although this segment also represents a work reality of children and adolescents[4,5].

In general, based on how its trade is conducted, street food is a risk to consumers' health, especially because of the absence of a minimum structure that allows the use of hygiene procedures. Moreover, other factors, such as poorly trained vendors, inappropriate hygiene habits and inadequate knowledge on food handling techniques, have been reported in studies with packmen[6-8].

In this complex picture, while this trade provides employment, income and better quality of life to part of the population, it may also make people fall victims to their ignorance of proper food handling practices, since foods may carry many pathogens[1,9]. This is a special concern with regard to children and adolescents, since underage vendors usually do not know how to properly handle and conserve foods, so they represent a source of possibly unsafe foods for the population.

On the beaches of *Salvador* (BA) and metropolitan region, it is common to see children and adolescents selling foods and beverages, including homemade and processed foods. Among these, boiled quail eggs sold in their shells stand out, since they are much appreciated for their taste, nutritional value and aphrodisiac properties[10], and are easy to carry by underage vendors.

As indicated by some data from the Instituto Brasileiro de Geografia e Estatística[11], the national production and consumption of quail eggs has been growing, and the main producers are the Brazilian Southeast and the states of *Pernambuco* and *Bahia*. Raw eggs are perishable and susceptible to changes that affect its quality. The rate of these changes depends on storage temperature and conditions[12].

Generally, raw eggs are contaminated after they are laid, with little or no contamination during oviposition[13-15]. Possible contamination routes include transovarian contamination and direct contact with bird feces, which facilitate the entrance of microorganisms through the shell pores, limiting the number of processes that are capable of disinfecting raw eggs[15].

When shelled eggs are boiled, they require additional care, since this thermal treatment destroys the protective membrane that lines the shell and exposes the pores to bacteria that may contaminate them. Hence, for better safety and preservation, home-boiled eggs should be refrigerated within two hours of boiling and consumed within one week[16].

Given the above, this study aimed to characterize the trade and microbiological safety of home-boiled, shelled quail eggs sold on the waterfront of *Salvador* (BA) from the child labor perspective.

METHODS

This descriptive, cross-sectional study was done between January and October of 2010 on the waterfront of *Salvador* as part of the project "*Comida de rua e trabalho infantil: o descortinar de uma realidade na orla marítima de Salvador* (BA) *e a busca da segurança alimentar e da inclusão social*" (Street food and child labor: unveiling a reality on the waterfront of *Salvador* (BA) and the quest for food safety and social inclusion).

Calculation of the sample size of the abovementioned project was based on a child labor prevalence of 8.7%, which includes all forms of labor of 5-to-17-year-olds in the Metropolitan Region of *Salvador* (BA)[17]. An error of 3.0% and critical α of 0.05 were used in the calculation, resulting in a sample size of 340 vendors.

A preliminary study identified the most common foods sold by underage vendors on 18 beaches. Given the absence of information necessary for the calculation of a probabilistic sample of quail egg vendors, a non-probabilistic subsample of 40 vendors was established for data and sample collection. Accidental sampling[18] was used in eight waterfront locations - *São Tomé de Paripe, Ribeira, Boa Viagem, Canta Galo, Patamares, Jaguaribe, Piatã and Itapuã*. The study was done on weekends, that is, Saturdays and Sundays, during the day.

A semi-structured questionnaire previously tested by a pilot study was used for collecting information about the trade and vendors. The questionnaire was divided into four sections: vendor socioeconomic characteristics; food profile, acquisition and storage; hygiene and sanitary characteristics of the vendor and work; and vendor opinion.

The questionnaire was filled out by trained, supervised interviewers who collected information by direct observation and interview, depending on the question.

A sample of 15 boiled quail eggs, enough to compose an analytical unit, was purchased from each vendor for assessment of their microbiological profile. A total of 40 samples were acquired. The samples were collected aseptically, placed in sterile plastic bags which were then placed in coolers with ice and sent to the Laboratory of Food Quality Control of *Universidade Federal da Bahia* (UFBA) School of Nutrition. The samples remained under refrigeration for a maximum of four hours until analysis.

Microbiological analyses of the quail eggs consisted of Mesophilic Aerobic Microorganism (MAM) count, Coagulase-Positive Staphylococcus (CPS) count, Most Probable Number (MPN) of total and thermotolerant coliforms/*Escherichia coli*, and testing for *Salmonella spp.* (SAL). The procedures were done as recommended by the American Public Health Association (APHA)[19].

In order to analyze the external and internal contamination of the quail eggs as suggested by the International Organization for Standardization (ISO) 6887-4[20], the broken shells and eggs were soaked together in the collection bags. This procedure was chosen because boiled quail eggs are handled by vendors and consumers, who then peel the eggs with bare hands and transfer microbes from the shells and hands to the egg, which is then eaten.

The results of the microbiological analyses were compared with the limits established by Resolution RDC nº 12/2001[21], issued by the *Agência Nacional de Vigilância Sanitária* (Anvisa, National Sanitary Surveillance Agency). The study food was classified as a ready-to-eat dish (ready-to-eat foods prepared in home kitchens, restaurants and similar establishments), category A, which includes meat-based foods, boiled eggs and similar foods. This classification was based on the similar nature and processing of the product.

The data collected by the questionnaires were entered in a database and analyzed by the software Statistical Package for the Social Sciences (SPSS), version 20.0. The study variables were analyzed descriptively and the Pearson's chi-square test was used for investigating associations of interest among the variables. The significance level was set at 5% ($p<0.05$). The prevalence of samples contaminated by indicator and pathogenic microorganisms was also calculated by dividing the number of samples not complying with the legislation by the total number of samples.

As required by Resolution nº 196/96[22] issued by the National Health Council, the study was approved by the Research Ethics Committee of the UFBA *Hospital e Maternidade Climério de Oliveira*, located in *Salvador* (BA), under protocol number 14/2008. The interviews were done after the vendors' guardians signed a free and informed consent form or, if the guardians were not around, when vendors agreed to participate in the study.

RESULTS

Vendor identification and socioeconomic characteristics

Most vendors were females and many start selling street food on the waterfront of *Salvador* (BA) before reaching legal working age. Additionally, most children and adolescents interviewed by this study reported attending school regularly, and 72.5% reported that their families were on welfare, confirming their social vulnerability. A small percentage (5.0%) of the older vendors were school dropouts, but vendor age was not significantly associated with education level ($p=0.26$).

Most vendors did not limit their sales to a single beach and also sold their products elsewhere. The working day of quail egg vendors is long, working an average of 6.6 hours per day, and they remain on the job for a long time, on average, 3.8 years.

Most vendors reported working on weekends to take advantage of the greater number of consumers on beaches and/or the days off school, although some vendors admitted to working during schooldays. Because of the long working day, most children and adolescents worked two shifts during the day.

Table 1 shows that vendors are either self-employed or have different employers: their families or someone close to their homes (relatives or neighbors). They have a mean gross income of R$38.31 *per* day. A complementary test that investigated the association between age and employer showed that, while adolescents were self-employed, children generally worked for their parents or third parties (p=0.03). Finally, adolescent quail egg vendors were more prevalent than child vendors, regardless of gender.

Supplementation of the family income was the most common reason for participants to become street food vendors (57.5%). Other reasons included the need of being financially self-sufficient (22.5%), having an occupation (17.5%) and turning their work into their main income means (2.5%).

Quail egg profile, acquisition and storage

In general, quail eggs sold on beaches were bought at a large farmer's market in *Salvador* (BA), called *São Joaquim*, or occasionally, in people's markets. The eggs were prepared at home by the vendors' mothers (57.5%), other family members (20.0%), neighbors (12.5%) or the vendors themselves (10.0%). After boiled, the eggs were returned to the original packaging (egg carton) and taken to the point of purchase.

On the beaches, 85% of the vendors piled the egg cartons, with 30 eggs each, on their arms, and 15% used plastic or cardboard boxes to carry the egg cartons and salt for seasoning, according to the customers' requests.

Hygiene and sanitary characteristics

Figure 1 shows the quail egg vendors' compliance with hygiene requirements. It is evident that compliance with hygiene criteria was inadequate, which adds to the age incompatibility of the vendors with the activities related to informal food trade.

The majority of the vendors reported washing their hands up to twice daily (47.5%), from two to five times daily (27.5%) and more than five times daily (12.5%). A few (12.5%) reported not washing their hands during their

Table 1. Demographic. socioeconomic and work characteristics of street food vendors (n=40) who sell boiled quail eggs on the beaches of *Salvador* (BA), Brazil, 2010.

Characteristics	Distribution	
Gender (%)		
Female	57.50	(23)
Age		
Mean (amplitude)	13.30	(8 - 17)
School attendance (%)		
Yes	95.00	(38)
Work location (%)		
Only one beach	37.50	(15)
More than one beach	57.50	(23)
Other locations	5.00	(2)
Length of employment (years)		
Mean (amplitude)	3.80	(0.08 - 10)
Working day (hours)		
Mean (amplitude)	6.60	(3 -13)
Work days (%)		
Saturdays and Sundays	82.50	(33)
Monday to Friday	15.00	(6)
Every day	2.50	(1)
Work shift (%)		
Morning	2.50	(1)
Afternoon	17.50	(7)
All day	80.00	(32)
Employer (%)		
Self	25.00	(10)
Parents	52.50	(21)
Third parties	22.50	(9)
Daily gross income (R$)		
Mean (amplitude)	38.31	(7 - 80)

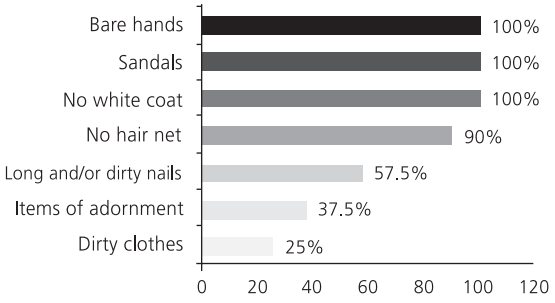

Figure 1. Personal hygiene particularities of children and adolescents (n=40) who sell boiled quail eggs on the waterfront of *Salvador* (BA), Brazil, 2010.

work shift. Generally, the vendors washed their hands at the water faucets available in beach stands (88.5%) or with seawater (11.5%).

Visual assessment indicated that 12.5% of the vendors had bad or terrible hygiene habits, 75.0% had regular hygiene habits and 12.5% had good hygiene habits.

Vendor perception of good handling practices and their work

When asked about the importance of hygiene in food trade, 97.5% of the children and adolescents considered it important, especially vendor hygiene. In parallel, most (62.5%) believed that street foods could cause diseases in those who consumed them.

Regarding the social aspect of work, 87.5% of the vendors reported enjoying the activity, while the others reported dissatisfaction, sadness or fatigue. On the other hand, when asked about what they wish they could be doing, 77.5% wanted to be doing some leisure activity if they were not busy working.

Microbiological profile of boiled quail eggs

Table 2 shows the results of the microbiological analyses of the boiled quail egg samples. The mesophilic aerobic microorganism counts varied greatly, with 5.0% (n=2) of the samples having counts in excess of 5.0 log Colony-Forming Units per gram (CFU/g).

With respect to total coliforms, 80.0% (n=32) of the samples exceeded 1.3 log MPN/g. Meanwhile, the MPN of thermotolerant coliforms of an expressive percentage of the samples (22.5%) exceeded the limit established by Resolution nº 12/2001[21]. Moreover, *E. coli* was found in 15.0% (n=6) of the samples, confirmed by the Indole, Methyl red, Voges-Proskauer and Citrate tests (IMViC).

Coagulase-Positive Staphylococcus counts exceeded the tolerated limit in 45% (n=18) of the samples and in many others, CPS counts were very close to the tolerated limit. *Salmonella spp.* was not found in any of the samples.

Table 2. Characterization of the boiled quail egg samples (n=40) acquired on the waterfront of *Salvador* (BA) regarding their microbial contamination (log of the Most Probable Number (MPN) or Colony-Forming Units (CFU/g). 2010.

Microorganisms	Count			RDC nº 12/2001 Standard	Noncompliant[a] n (%)
	M	SD	Amplitude		
Mesophiles	2.43	1.20	1.30 - 5.51	NA	NA
Total coliforms	1.58	0.86	0.47 - 3.04	NA	NA
Thermotolerant coliforms	0.98	0.98	0.47 - 3.04	1.3	9 (22.5%)
Coagulase-positive staphylococci	2.01	2.00	0.00 - 5.25	3.0	18 (45.0%)
Positive samples n (%)					
Escherichia coli	6 (15.0%)			NA	NA
Salmonella spp.	—			Not found	—
Study samples n (%)					Non-compliant samples
Total	40 (100%)				22 (55%)

Note: [a]Not in compliance with the current microbiological standards. NA: Not Applicable; M: Mean; SD: Standard Deviation.

The prevalence of samples not complying with the legislation[21] was considered high (55%), given that the product had been boiled.

According to Pearson's Chi-square test, vendor age and sample noncompliance were not significantly associated.

DISCUSSION

The presence of female street vendors evidenced by the present study is in disagreement with studies[23-26] that reported that this kind of work is essentially done by males. In this context, the presence and prevalence of girls selling quail eggs may be justified by the relative ease of the job.

As reported by vendors and their guardians, eggs are light compared with *coalho* cheese and ice pops, which require greater physical effort from packmen. Therefore, the selection of this product may be gender-related, since it requires less physical effort. However, as Acho-Chi[27] points out, the presence of girls in informal jobs is more concerning, since there is a correlation between this kind of work and risk of other social problems, such as adolescent pregnancy, early marriage or even child prostitution.

The results indicate that children become street vendors early. In this case, work exposes young packmen to a number of risks, since the required tasks are incompatible with their ages[8,25], even if most, especially girls, are supervised by adult family members during their work - a strategy employed by families to minimize job-related risks. According to Schwartzman[28], working children aged 5 to 9 years are more prevalent in low-income families.

The long working day and length of employment found by the present study not only make school attendance impossible or unfeasible, but also confirm the relationship between child labor and contribution to family income, that is, children and adolescents stay on the job for very evident economic reasons[23,29].

The work characteristics of these vendors unveil a reality that violates the *Estatuto da Criança e do Adolescente* (ECA, Child and Adolescent Statute), and reveal the fragility and vulnerability of the children and adolescents involved in this type of work. In this sense, many risks may be present in their daily routine, such as injuries, long walks in the sun, dehydration, and sexual and/or moral harassment, as pointed out by Carvalho[25] and Audu *et al.*[30].

The greater participation of adolescents of both genders in this activity probably reflects families' attempts to preserve the younger children, delaying their joining street trade.

Supplementation of the family income as the main justification for becoming a street food vendor may be easily associated with the poverty level of the families involved. However, other determinants may be identified, such as the current economic model that promotes social inequality, market structure, which allows the presence of children and adolescents in the informal sector, and the positive cultural aspect of work[31-33].

In addition to contributing to the family income, other reasons were mentioned by vendors for having joined the segment, such as having an occupation or becoming financially self-sufficient by selling foods on the city's beaches, which coincide with the reasons reported by Gonçalves *et al.*[34] when they described the profile of 14- and 15-year old adolescents in a mid-sized city in the Brazilian South.

This information is also in agreement with Rizzini[35], who stated that in this age group, individual factors, such as wanting to have self-earned money, more freedom and an occupation or trade, add to cultural factors, such as the belief that work promotes discipline.

Regarding the preservation of the marketed product, the United States Department of Agriculture (USDA)[16] recommends that boiled eggs should be cooled within two hours of boiling and consumed within one week.

Although the vendors have reported selling all eggs on the day of preparation, this trade requires walking, so the vendors carry their products along city beaches, in the sun for long periods of time and in adverse preservation conditions, promoting the loss of hygienic and sanitary quality of the quail eggs and risks for the consumers.

Furthermore, according to some vendors' reports, often when the eggs were not sold on the same day they were boiled, the vendors would try to sell them on the next day, regardless of the storage conditions, that is, whether they had been refrigerated or not.

The results that characterize the hygiene of the young vendors reflect their inability, when compared with adult vendors, to meet food trade requirements. However, even adult food vendors who work in the informal sector have been blamed of unsatisfactory hygiene practices by Mallon & Bortolozo[36] in a study of adult packmen from *Paraná*, and by Omemu & Aderoju[9] and Umoh & Odoba[37] in studies that assessed the hygiene practices of street food vendors in Africa.

Other studies have found more concerning results[37-39], such as vendors with inadequate hygiene habits and working in inappropriate conditions.

Considering the microbiological profile of the study samples, although the legislation does not establish a limit for mesophiles, their count indicates the general contamination of a food and its hygiene quality. Hence, their counts allow the assessment of the hygiene and preservation status of a food[19,40].

Although the mean mesophile count found by the present study was not high, two samples (5%) contained counts in excess of 5.0 log CFU/g, which may suggest inappropriate handling, processing and/or storage, and/or exposure of the product to adverse environmental conditions[40].

Likewise, there are no standards for total coliforms but the comparison of the study counts for this group of microorganisms with the specific standard for MPN of thermotolerant coliforms per gram may be useful for indicating inadequate hygiene after processing[41]. Given that 80.0% (n=32) of the samples had high total coliform counts and that 22.5% (n=9) exceeded the limit for thermotolerant coliforms established by the legislation[21], the results are concerning, especially when one considers that boiling kills many microorganisms.

Additionally, the high coagulase-positive staphylococcus count found in 45.0% of the samples indicates inappropriate storage and handling, since humans are one of the main reservoirs of this microorganism[42]. This statement is confirmed by the field findings, that is, many vendors were not careful when handling the product and maintained the product under inappropriate temperature and storage conditions for long periods of time.

This finding is similar to one found by Umoh & Odoba[37] when they investigated the quality of street food sold in Zaria, Nigeria, considering the pertinent proportions, since the latter assessed different foods. The literature on quail eggs focuses on fresh quail eggs and the profile of their consumption and consumers. Thus, the scarcity of information on the quality of boiled quail eggs prevented the direct comparison of the results of the present study with other studies.

On the other hand, even though contamination by *Salmonella spp.* has not been found in the study samples, the counts of indicator microorganisms suggest that better handling practices are necessary, especially after the product is boiled, since boiling destroys the protective membrane that lines the shell, facilitating microorganism access to the egg white and yolk[16].

Few of the vendors reported cleaning the egg cartons used for transporting the boiled eggs. Hence, not cleaning the egg cartons or not cleaning them properly may partly justify the

microorganism counts, since the boiled eggs may be suffering cross-contamination.

More importantly, consumers believe that boiled eggs inside their shells are safe. However, when they handle and peel the eggs with unwashed hands, they not only contaminate the eggs with the microorganisms present on their hands, but also with those present on the shells, increasing the microbial load of the food.

CONCLUSION

The objective of this study was to characterize the trade and describe the microbiological quality of boiled quail eggs sold on the waterfront of *Salvador* (BA) from the child labor and food safety perspective. In addition to confirming the presence of minors selling street foods, the study results also point out the social risks associated with the work routine of the children and adolescents involved.

What is more, the expressive prevalence of noncompliant samples indicates that the consumption of quail eggs on beaches poses a health risk. Therefore, the inept labor of the vendors combined with unfavorable work conditions may have contributed to the study results.

Given the nature and complexity of child labor and the problems associated with informal food trade, strategies are needed to protect consumers' health and the children and adolescents who work as street food vendors, and to ensure the quality of the foods sold.

CONTRIBUTORS

VIDAL JÚNIOR PO collected, analyzed and interpreted the data and wrote the article. CARDOSO RCV participated in data analysis and interpretation, and article writing and review. ASSUNÇÃO LS collected, analyzed and interpreted the data and helped to write the article.

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