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CONSUMER PRACTICES FOR PURCHASE, STORAGE, AND PREPARATION OF POULTRY AND EGGS IN SELECTED NORTH AND SOUTH AMERICAN COUNTRIES: A PILOT STUDY

PRÁCTICAS DE CONSUMO ACERCA DE LA COMPRA, ALMACENAJE Y PREPARACIÓN DE AVES DE CORRAL Y HUEVOS EN PAÍSES SELECCIONADOS DEL NORTE Y DE SUR AMERICA: UN ESTUDIO PILOTO

Kadri KOPPEL, Ph.D.^{*1}, Miriam SOSA, Dra.², Nelson G. GUTIERREZ, Ph.D.³, Paula CARDINAL, Lic.², Sandria L. GODWIN, Ph.D.⁴, Sheryl C. CATES, BA.⁵, Edgar CHAMBERS IV, Ph.D.¹

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ABSTRACT

Background: Poultry, eggs, and their products represent a potential food safety hazard. Although consumer practices related to these foods have been studied in various countries, little data exists from Latin America. **Objective:** The objective of this pilot study was to provide initial data to characterize consumers' purchase, storage, handling, and preparation of poultry products and eggs in three countries: Argentina, Colombia, and USA. **Methods:** Consumers (n = 425 total) in each location completed a questionnaire about poultry products and egg purchase locations, storage conditions (i.e. refrigerator or freezer), preparation and handling practices, and managing leftovers. **Results:** The results indicated that in the USA most surveyed consumers purchased refrigerated eggs, whereas in Argentina (91%) and Colombia (84%) eggs typically were purchased at room temperature. Furthermore, almost all consumers in the USA stored eggs in the refrigerator, but 23% of Argentinian and 45.9% of Colombian consumers stored eggs at room temperature, which is potentially an unsafe practice. Some practices supported possible cross-contamination, for example washing raw eggs and poultry prior to cooking. **Conclusions:** These results are a first comparison across countries in the Americas of consumer poultry and egg practices and can serve as the basis for further research and development of food safety educational messages.

Keywords: Eggs, food safety, poultry, Colombia, Argentina

RESUMEN

Antecedentes: Aves de corral, huevos, y sus productos representan un potencial peligro en la seguridad alimentaria. Prácticas de consumo relacionadas con estos alimentos han sido estudiadas en varios países, pero pocos datos existen de Latinoamérica. **Objetivo:** El objetivo de este estudio piloto fue proveer información de manera de caracterizar la compra, almacenaje, y preparación de aves de corral y huevos en tres países: Argentina, Colombia, y Estados Unidos. **Métodos:** Consumidores (n=425 en total) en cada

locación, completaron cuestionarios acerca del comercio de compra de aves de corral y huevos, condiciones de almacenamiento (e.j. refrigerador o freezer), preparación y prácticas de manipulación, y manipulación de sobras. **Resultados:** Los resultados indicaron que en Estados Unidos, la mayoría de los consumidores encuestados adquiere huevos almacenados en refrigeración, mientras que en Argentina (91%) y Colombia (84%) los huevos adquiridos estaban almacenados a temperatura ambiente. Asimismo, casi la totalidad de los consumidores en Estados Unidos almacenan los huevos en refrigeración, mientras que un 23% y un 45.9% de consumidores Argentinos y Colombianos, respectivamente almacenan huevos a temperatura ambiente, lo cual potencialmente significa una práctica no segura. Algunas prácticas sostienen posible contaminación cruzada, por ejemplo el lavado de aves y huevos previos a la cocción. **Conclusiones:** Los resultados muestran una primera comparación entre países de América sobre las prácticas de consumo de aves de corral y huevos, que servirán como base para futuras investigaciones y desarrollos de mensajes educativos sobre seguridad alimentaria.

Palabras clave: Huevos, seguridad alimentaria, aves de corral, Colombia, Argentina.

INTRODUCTION

Several steps in the food production and distribution system could be responsible for food contamination; however, consumers often are the last ones to manipulate food before consumption and ultimately are responsible for any mishandling at home. Kennedy *et al.* found that the main determinants of contamination for other foods while handling raw meat and poultry were related to washing contaminated hands, cutting boards, and knives during and after cooking (1). Reviews of general food safety practices by consumers have stressed the importance of educating the consumer (2) and sometimes have found different results from surveys in comparison to observational studies (3). Studies on USA consumer purchase (4-5), preparation (6), and storage practices (7-8) have found that educated consumers are more likely to engage in risky food handling practices. Income, age, race, and gender are commonly collected demographics that could predict behavior characteristics. Thus far, studies have found male consumers to be less aware of food safety practices and that high income does not necessarily predict knowledge of food safety practices (9).

Food safety studies in multiple countries

Most studies that have looked at food safety and practices including those for eggs and poultry products are focusing on consumers in single countries. In North America, an abundance of examples can be drawn from the USA (4,8,10-12) and some in Canada (13). Fewer studies have been conducted in South America. For example, Califano, Antoni, Giannuzzi, and Mascheroni studied unsafe practices at homes in Argentina and discovered a number of violations of food safety guidelines; these authors suspected that this is a cultural, rather

than an educational issue (14). Studies that describe consumer poultry or egg handling practices in Colombia are scarce. In one study conducted by Forero and Romero knowledge and practices of food handling in households in Bogota, Colombia were evaluated (15). Those authors found that there is a need for consumer education about food safety practices. Studies have rarely focused on food safety issues related to eggs and poultry purchase, storage, or behavior in multiple countries. One of the few examples studied consumer perceptions of chemical and microbiological risks related to water, poultry, fish, and milk powder in four European countries and Brazil (16). During focus groups those authors found that consumers considered chemical contaminants more hazardous and less controllable than microbiological risks. Koppel, Suwonsichon, Chitra, Lee, and Chambers studied eggs and poultry-related practices in three Asian countries (17). Those authors found that considerable differences exist among Asian countries consumer practices. Furthermore, practices in selected European countries have been studied by Koppel, Timberg, Shalimov, Vazquez-Araujo, Carbonell-Barracchina, Di Donfrancesco, and Chambers (18).

The lack of cross-cultural food safety studies is problematic given the prevalence of food borne illness around the world and the risk associated with consumption of contaminated poultry products (19). In addition, with increased immigration (for example from Latin American to the USA) cultural practices that are common in one country likely will be practiced in the new country. The benefits of cross-cultural studies include increased knowledge regarding possible cross-contamination, spoilage, and resulting food-borne illnesses and a uniform research approach to consumers that

would allow data comparison. Furthermore, this data could prove helpful in developing consumer educational messages to prevent risky practices across countries and cultures if similarities exist or show where messaging needs to be different when practices differ.

The objective of this pilot study was to characterize consumers' purchase, storage, handling, and preparation of poultry products and eggs in selected locations of three North and South American countries: Argentina, Colombia, and USA.

MATERIALS AND METHODS

Questionnaire and Data Collection

The questionnaire was developed in English and translated into Spanish and back-translated into English by native speakers to ensure the questionnaire was comparable across countries. The questionnaire was tested on food safety experts and staff before the study was conducted to ensure adequacy of respondent understanding. Data was collected in November and December 2012 and in January, February, and March 2013 in the USA, Colombia, and Argentina. The information was gathered via an online survey (Kansas, Missouri, USA), at a central location (Nashville, Tennessee, USA; Buenos Aires, Argentina), and via one-on-one interviews (Huila, Colombia). The questionnaire was the same as used by Koppel *et al.* in a comparison of Asian consumers' food safety related practices (17). The consumers in this study don't represent an entire country's consumers, but do provide a glimpse at the similarities and differences among the various countries.

The questionnaire collected information on a wide range of home storage and handling practices. Information from 11 selected multiple-choice questions regarding consumers' egg and poultry related purchase, storage, refrigeration, and preparation practices is presented in this paper.

Demographic information regarding consumer gender, age (<35; ≥35), household income (low: <\$25,000; medium: \$25,000-\$50,000; high: >\$50,000 or equivalent as determined by the country), education level (less than college; some college courses or higher) was collected at the end of the questionnaire. Income categorization for Colombia was not available. Demographic information is shown in Table 1.

Table 1. Demographic information of participating consumers

Demographic segmentation, %	USA (n=227)	Argentina (n=100)	Colombia (n=98)
Gender			
Male	26.4	0.0	30.6
Female	73.6	100.0	69.4
Age			
<35	55.5	23.0	54.1
≥35	44.5	77.0	45.9
Education			
Less than college	9.3	59.0	43.9
Some college courses or more	90.7	41.0	56.1
Income			
Low	51.5	52	N/A*
Medium	30.4	48	N/A
High	18.1	0	N/A

*N/A – income information not available for Colombia.

Respondents

All participating respondents were pre-screened according to the following conditions: age >18; the respondent was the primary food shopper in the household or shared food shopping responsibility with someone else; the respondent was the food preparer and knew about food storage in the household or was one of several people who cooked and knew about food storage in the household, and the consumer had a refrigerator in their home. A total of 227 respondents from Kansas, Missouri, and Tennessee in the USA, 100 from the Buenos Aires region of Argentina, and 98 from the Huila (Neiva) region of Colombia completed usable questionnaires. Respondents in the Kansas and Missouri area were recruited from a database of consumers and were reimbursed for their participation in the amount of \$10. Respondents in Tennessee area were not reimbursed for their participation and were recruited as a convenience sample among the students in Tennessee State University and Nashville State Community College and parents of local schoolchildren. Respondents in the Buenos Aires area in Argentina were recruited among parents of schoolchildren attending public schools, among women receiving monthly food aid, and among women listed in a consumer database. Respondents in Huila area in Colombia were recruited among homemakers and office workers.

Data Analysis

Chi-square tests were performed on collected frequencies to study the relationships between the countries studied. The analysis was conducted using the Excel function CHITEST (Microsoft Excel 2010, Microsoft, Redmond, WA, USA).

RESULTS

Purchase and storage behavior

The respondents were asked to indicate their means of obtaining fresh eggs. In the USA and in Colombia most surveyed respondents and in Argentina 32% of respondents purchased eggs from the store or supermarket (Table 2). In addition, 48% of Argentinian respondents purchased eggs from a local market, while in Colombia and USA this practice was not common. Significantly more ($p < 0.05$) consumers purchased eggs from

the farmer directly or raised their own chickens in Colombia and Argentina.

At the time of purchase, eggs typically were either refrigerated or at room temperature, depending on the regulations in each location. The respondents were asked to indicate if during purchase the fresh eggs had been refrigerated or not and their way of storing the fresh eggs at home. Eggs usually were refrigerated in the USA (96%) at the time of purchase, but were at room temperature in Colombia (84.7%) and Argentina (91%) (Table 2). In addition, 45.9% of surveyed consumers in Colombia and 23% of consumers in Argentina stored raw eggs at room temperature in their homes (Table 2). In the USA most consumers stored eggs in the refrigerator.

The respondents were asked about storage practices of cooked eggs in the shell. Total of 22% of surveyed Colombian consumers stored cooked eggs in the shell at room temperature or did not know how to store cooked eggs (Table 2).

Table 2. Purchase, storage, and preparation practices of raw poultry and eggs by % of respondents

	Question	USA	Colombia	Argentina	<i>p</i> -value
1*	Direct from farmer at his/her farm or you raise your own chickens	5.7**	17.3	20.0	0.00
	Store (such as grocery specialty wholesale or discount)	88.1	80.6	32.0	0.00
	Market (such as farmers market)	6.2	2.0	48.0	0.00
2	Refrigerated	96.9	15.3	9.0	0.00
	Room temperature	3.1	84.7	91.0	0.00
3	In refrigerator	98.2	54.1	76.0	0.00
	At Room temp	1.3	45.9	23.0	0.00
	Don't know	0.4	0.0	1.0	0.59
4	In refrigerator	92.4	77.6	90.9	0.41
	At Room temp	4.9	17.3	4.0	0.00
	Don't know	2.7	5.1	5.1	0.46
5	Yes I always wash raw poultry	42.3	93.8	15.0	0.00
	Yes I always wash eggs	3.5	1.0	29.0	0.00
	Yes I always wash raw poultry and eggs	3.5	0.0	23.0	0.00
	Sometimes if they seem dirty	14.1	3.1	21.0	0.00
	No	36.6	2.1	12.0	0.00
6	1 hour or less	79.0	61.2	91.0	0.06
	More than 1 hour but less than 2 hours	17.9	35.7	6.0	0.00
	More than 2 hours but less than 3 hours	2.7	1.0	2.0	0.64
	More than 3 hours but less than 4 hours	0.4	2.0	0.0	0.19
	4 hours or more	0.0	0.0	1.0	0.20

* 1 - Where do you usually buy eggs?; 2 - When you usually buy eggs are they refrigerated or at room temperature?; 3 - How would you say you usually store raw eggs (in the shell)?; 4 - How would you say you usually store cooked eggs (in the shell)?; 5 - Do you wash raw poultry/eggs before cooking them?; 6 - The last time you had leftovers from a freshly prepared salad that contained eggs or mayonnaise, how long did you let the leftovers sit at room temperature before you put them in the refrigerator or ate them later without refrigeration?

**Values shown in bold are statistically significantly different among the countries according to chi-square test ($p < 0.05$).

Preparation and Storage Behavior

The respondents were asked to indicate whether they would usually wash raw poultry or eggs before cooking. Approximately 46% respondents in the USA, 93% in Colombia, and 38% in Argentina reported washing raw poultry before cooking. Furthermore, 29% of Argentinian respondents reported washing raw eggs (Table 2). Most Colombian and USA respondents did not report washing raw eggs. An additional 3-21% of respondents claimed washing poultry or eggs only if after visual inspection it seemed necessary.

This study found that most Argentinian and Colombian consumers would either wash poultry, or wash both eggs and poultry before cooking; in comparison to 42% of USA consumers claimed to wash poultry, and this may be related to higher consumer knowledge of safe food preparation practices.

The respondents were asked to specify the approximate time before they would refrigerate a home-made salad with mayonnaise. The majority of respondents stored home-made salads with mayonnaise within 2 hours of preparation at room temperature (Table 2). A total of 79% of USA, 61% of Colombian, and 91% of Argentinian consumers would refrigerate the freshly prepared salads within 1 hour or less.

DISCUSSION

Purchase and storage behavior

Total of 48% of Argentinian respondents purchased eggs from a local market, while in Colombia and USA this practice was not common. Purchasing fresh eggs from a farmer's market has not been found common in selected Asian countries (17) or in selected European countries, either (18). Total of 17 and 20% of consumers purchased eggs from the farmer directly or raised their own chickens in Colombia and Argentina, respectively. Similar practices have been observed in Italy and Spain (18). These findings are important considering recent data from the USA showing that poultry products purchased at farmers' markets had higher levels of bacteria such as *Salmonella* and *Campylobacter* when compared to those purchased from supermarkets (20). That study also found that organically produced poultry had higher levels of bacteria than did conventionally produced chickens, even when purchased from the supermarket.

Eggs usually were refrigerated in the USA at the time of purchase, and similar practices have been observed in Estonia (18) and Korea (17). Eggs during purchase were at room temperature in Colombia and Argentina, as well as in India (17), Italy and Spain (18). In addition, 45.9% of surveyed consumers in Colombia and 23% of consumers in Argentina stored raw eggs at room temperature, while most European and Asian consumer stored eggs in the refrigerator (17, 18). In the USA most consumers stored eggs in the refrigerator, and these findings are in line with those from Godwin and Coppings (4).

At the time of purchase, eggs typically were either refrigerated or at room temperature, depending on the regulations regarding storage, and egg pre-treatment, such as washing by the manufacturer, in each location. However, it is not known how well consumers in different countries are informed of the local food safety regulations. Considering the annual average temperatures of each of these locations, storing at room temperature likely impacts the shelf life of eggs. In addition to variation in retail refrigeration practices in these locations, at home most of the USA consumers refrigerated the eggs, while portions of Argentinian and Colombian respondents did not. This may be caused by cultural differences among the consumers, such as purchasing groceries on the same day or day before using the groceries in food. This study did not ask about the quantities of the eggs purchased at one time, the packaging methods of the eggs, or the time eggs would be stored at home. This type of data would provide more understanding of actual potential risks in everyday practices of these consumers.

Colombian and Argentinian consumers were significantly more likely to store raw eggs at room temperature than USA consumers ($p=0.000$). This practice could subject consumers to a higher risk for foodborne diseases, such as Salmonellosis. Still, refrigeration is only effective in preventing foodborne illnesses if the refrigerator is cleaned regularly and maintained at correct temperatures (21).

Preparation and Storage Behavior

The respondents were asked to indicate whether they would usually wash raw poultry or eggs before cooking. Approximately 46% respondents in the USA, 93% in Colombia, and 38% in Argentina reported washing raw poultry before cooking. Variable portions of consumers have been found

to do the same in other countries. For example, in Estonia 29% of the surveyed consumers reported to wash raw poultry, while 40% of Italians and 44% of Spaniards reported the same (18). Furthermore, 29% of Argentinian respondents reported washing raw eggs, while most Colombian and USA respondents did not report washing raw eggs. Washing raw eggs was less common in Asian countries, as well, as reported by Koppel *et al.* (18).

In the USA consumer education tools are of high quality and readily available in the Internet. Some studies have conducted interventions and improved consumers' food safety related behavior through these (22). According to the Food Safety and Inspection Services on-line materials (23) washing raw meats and poultry is not recommended due to possible cross-contamination to kitchen surfaces. Other countries, however, rarely have these types of educational tools and this is reflected by consumer knowledge and practices. This study found that most Argentinian and Colombian consumers would either wash poultry, or wash both eggs and poultry before cooking; in comparison to 42% of USA consumers claimed to wash poultry, and this may be related to higher consumer knowledge of safe food preparation practices. In comparison in Thailand it was found that approximately half of the consumers washed both raw chicken and eggs before cooking (17).

Home-made mayonnaise and home-made salads with mayonnaise should be stored carefully (24). FSIS recommends that freshly prepared salads be refrigerated within 2 hours of preparation (25). *Salmonella enteritidis* was able to grow rapidly in salads and mayonnaise that was stored at 25 °C, but not when stored at 10 °C (5). *Listeria monocytogenes*, however can grow in contaminated pasta and egg salads even in cold storage (26). According to this study the majority of respondents followed this recommendation in USA, Argentina, and Colombia (Table 2). It appears that consumers either knew about this recommendation or have other reasons for putting food away quickly. Future studies should investigate if actual practice times are similar to the reported practice times as research has shown self-reported practices to be less precise than practices observed (27).

Cross-cultural study

This study was the first study to compare food safety practices among North and South American countries. The importance of the study is in the

comparison and collected knowledge of consumer practices from three countries that could be used in developing a uniform approach in educating consumers about food safety. However, there are some limitations to the study as well. The consumers recruited in each country were not balanced by their sociodemographic background information and this made comparison of consumer segments difficult. Furthermore, the respondents were recruited as a convenience sample and this does not necessarily represent average responses of the consumers in the community. Still, the results of this study for the USA were similar to a nationally representative study conducted in the USA (5) and may help in providing a more uniform understanding about culturally specific food preparation practices.

The cross-cultural approach of this study found that there are differences among surveyed consumers in the USA, Argentina, and Colombia. Future studies would benefit from including culture-specific aspects into questionnaires. These aspects may be pre-determined by conducting focus group studies or consumer interviews and may include issues like specific food preparation or purchase practices (28-29).

CONCLUSIONS

This pilot study evaluated consumers' self-reported purchase, storage, handling, and preparation of poultry products and eggs in three North and South American countries: Argentina, Colombia, and the USA. Some differences were found in purchase and storage behaviors among consumers in all three countries. For example, while most consumers in the USA stored eggs in the refrigerator, 23% of Argentinian and 45.9% of Colombian consumers stored eggs at room temperature. This study also showed some risky handling and preparation practices, such as storing raw eggs at room temperature (Colombia) and washing poultry and chicken. Further studies should investigate topics such as storage times of eggs in Colombia and Argentina to determine potential risk of storing eggs at room temperature, and potential educational interventions that could educate consumers about safe practices.

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