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Egg Contribution Towards the Diet of Pregnant Latinas

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Abstract

Proper nutrition during gestation is important to prevent adverse pregnancy outcomes. Eggs contain many important nutrients necessary for fetal development and human survival. Three focus groups were conducted with Latina women living in Connecticut to identify cultural beliefs toward egg consumption during pregnancy, traditional egg dishes, and methods of preparation. A cross-sectional study was then carried out with a sample of predominately Puerto Rican pregnant Latinas (N = 241) to identify the frequency of consumption of eggs and egg-containing dishes as well as methods of preparation using a tailored food frequency questionnaire modified for this population. Paired sample *t*-tests were used to examine if there were differences in weekly mean egg intake patterns between the year prior to the pregnancy and during pregnancy based on a Food Frequency Questionnaire. Women were categorized into eggs consumers and non-consumers if they consumed or did not consume eggs during the previous day based on 24-hour recall data. Independent-sample *t*-test and chi-square cross-tabulation analyses were conducted to examine the association between egg consumption and nutrient intake categories. Results showed that eggs and egg-containing traditional dishes are consumed by Latinas before and during pregnancy. Egg

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consumers had higher intakes of protein, fat, vitamin K, vitamin E, selenium, beta carotene, lutein and zeaxanthin, cholesterol, total polyunsaturated fatty acids, and docosahexaenoic acid. Eggs contribute significantly to the diet of pregnant Latinas.

Keywords

egg; food intake; nutrients; Latinas; pregnancy; WIC program

INTRODUCTION

Cultural, socio-economic, and demographic factors have a strong influence on dietary choices. However, little is known about how dietary intake patterns during pregnancy vary within and across racial/ethnic groups in the USA (IOM 2009). This gap in knowledge is of concern as nutrition during pregnancy has major implications for the health of both the mother and her offspring (IOM).

Latinos currently comprise 15% of the USA population and it is expected that by the year 2050 1 out of every 4 individuals living in the USA will be of Latino origin. Latinos are responsible for over half of the population growth in the USA and this fast growth rate will continue in the decades to come. Latinos come from 20 different countries of origin in Latin America and the Caribbean, and have come to the USA for different cultural, socioeconomic, and political reasons (Pérez-Escamilla 2009). Thus, it is important that studies seeking to document dietary intake patterns among pregnant Latinas include different subgroups from this community.

Few studies have specifically examined dietary intake patterns among pregnant Latinas. Schaffer and others examined energy and nutrient intake patterns and health practices among Latinas and non-Latina white women in California during the three months before becoming pregnant (1998). Results from this study demonstrated that foreign-born Latinas had higher cereal consumption and a lower fat intake than U.S.-born Latinas and non-Latina white women. As a result, foreign-born Latinas had the lowest intake of fat in relation to total energy intake compared to the other two groups. Despite high energy intakes, all three groups failed to meet the minimum recommendation for serving intakes of fruits and vegetables, and a high percentage of these women consumed inadequate daily levels of iron and calcium. Although this study provided an overview of nutrient intakes among Latinas, the majority were of Mexican descent. Other studies examining nutrition among pregnant Latinas have focused on Mexican American pregnant women, as well and very few on Puerto Rican pregnant women (Suitor, Gardner, and Feldstein 1990; Abrams and Guendelman 1995; Gutierrez 1999; Harley, Eskenazi, and Block 2005; Thornton et al. 2006). To our knowledge, only one study has examined nutrient intakes among a population of pregnant Puerto Rican women (Bowering, Lowenberg, and Morrison 1980). In this multiethnic sample in East Harlem, approximately half of the participants were Puerto Rican, one-third were African-American, and the rest were of Spanish or Haitian descent. Results obtained from the 24-hour dietary recall showed similar nutrient intakes between the 2 primary ethnic groups except for calcium intake, which was found to be lower among African-Americans, and vitamin C and vitamin A intakes, which were lower among Puerto Ricans. Thus, more studies are needed to examine dietary intakes among pregnant Latinas belonging to different ethnic sub-groups.

Egg Consumption during Pregnancy

Eggs are highly nutritious. They are a good source of high-quality protein, providing at least 11 essential nutrients (Applegate 2000). For this reason they are one of the foods provided

by the Supplemental Food Program for Women, Infants, and Children (WIC) (IOM 2005). Song and Kerver (2000) found that eggs contributed less than 10% of daily intake of energy and between 20 to 30% of vitamins A, E, and B_{12} to the diets of Americans. Eggs are also considered a functional food because they contain nutrients such as lutein and zeaxanthin which have potential health benefits when consumed at effective levels on a regular basis as part of a varied diet (Hasler 2000).

National surveys have found that egg consumption is common among Latinos. According to the 1994–96 CSFII USDA survey, the likelihood of daily egg consumption is 3 times higher among Latinos than among non-Hispanic Whites, (54.2% vs. 16.9%, respectively) (Food Surveys Research Group 1994). However, these studies have included predominantly non-pregnant Mexican-American Latino samples. Other studies have shown that egg consumption is also common among Puerto Ricans. A food safety study conducted among non-pregnant Puerto Rican caretakers during the year 2000 in Connecticut found that 90% (n = 100) of the study participants usually consumed eggs (44% prepared eggs well-done, 16% runny, and 40% both ways) and “egg rich” dishes, such as egg salad (55%) and potato salad (93%) (Bermúdez-Millán 2001; Bermúdez-Millán et al. 2004).

There is very limited data with regards to egg consumption during pregnancy, with most studies in this area focusing on the influence of consumption of eggs enriched with n-3 and n-6 PUFA’s on infants’ growth; brain, visual, and cognitive development; and intelligence (Montgomery 2003; Ingrid 2003; Craig 2000; Makrides 2008). None of these studies have attempted to understand cultural beliefs surrounding egg consumption during pregnancy. This is an important gap in knowledge because pregnancy represents a very sensitive period of time and studies in diverse cultures in developing countries suggest that there may be specific cultural beliefs surrounding the consumption of different animal protein sources, including eggs (Gittelsohn and Vastine 2003; Kuhnlein and Pelto 1997). Thus, it is important to better understand the nutrient contribution of eggs among pregnant low-income Latinas. Since recent changes in WIC policies may lead to lower access to eggs by pregnant and postpartum women participating in the WIC Program, findings from this area of research have important public health implications (IOM 2005).

The research reported here utilized a mixed methods (qualitative and quantitative) approach to gain insight into egg consumption beliefs and practices among pregnant Latino women in Hartford, Connecticut. The main objectives of this study are to (1) identify traditional egg dishes and methods of preparation among pregnant predominately Puerto Rican Latinas, (2) document egg consumption patterns among this target population, and (3) estimate the nutrient contribution from eggs towards their overall diet.

MATERIALS AND METHODS

Focus Groups

A total of 3 focus groups were conducted during the months of March and April 2004. The first focus group was conducted with the staff of the *Comadrona* Program at the Hispanic Health Council (HHC). The *Comadrona* Program is a prenatal, case management program with the mission of fostering positive pregnancy outcomes and infant health by providing social and emotional support through case management, health education, and home visits. The program serves approximately 300 women per year, the majority being Puerto Rican (59%). The second and third focus groups were held with *Comadrona* Program participants and Hartford WIC program participants, respectively. Participants were asked questions about overall diet, cultural beliefs and practices regarding egg preparation, and consumption during pregnancy (Table 1). *Comadrona* case workers were asked the questions in reference to the pregnant women to whom they offer services (Table 1). Focus group questions

included detailed direct and indirect questions on egg dietary cultural practices and beliefs during pregnancy. Direct questions included: *Do you consume eggs? How do you prefer to eat your eggs? Do you think pregnant women should consume eggs?* Indirect questions included: *Is there a particular food that you prepare at home that includes eggs as part of the recipe? Is there a particular food that you buy at the supermarket or local bakery that you might think it includes eggs?*

Based on the information collected at the focus group discussions, traditional egg dishes, and different methods of egg preparation were included in a 60-item food frequency questionnaire, previously developed for and used with women of reproductive age in this community (Tanasescu et al. 2000). In total, 11 egg-related food items typically eaten by this community were added (Table 2). The time periods of reference used to assess the frequency of consumption of these food items were the "year before the pregnancy" and "during pregnancy." These egg-related items were pre-tested among 10 Latinas with different ethnic backgrounds (Puerto Rican, Colombian, and Mexican) and subsequently added to an extensive prenatal survey that was used to collect data longitudinally about dietary practices of pregnant Latinas.

Dietary Intake Study

The data reported here were drawn from a longitudinal study conducted with a sample of 241 low-income Latino pregnant women between April 2004 and February 2007. Pregnant women were recruited from the Hartford WIC program, the Hispanic Health Council *Comadrona* Program, a local hospital, community organizations, and through street outreach (approaching participants at bus stops and walking in the streets). Pregnant Latinas were included in the study if they resided in the Hartford area, were 18 years or older, and were enrolled in the WIC program. Participants were read and signed an informed consent form in their language of preference (English or Spanish). To prevent a social desirability bias regarding egg consumption, participants were informed verbally and in the consent form that the study was conducted to assess the dietary habits of pregnant Latinas.

The survey used in this study collected data on (1) socio-economic and demographic characteristics, (2) food assistance program participation, and (3) dietary assessment. Egg consumption patterns were assessed by means of (1) a food frequency questionnaire, (2) egg dietary practices survey, and (3) a single 24-hour dietary recall.

Participants were asked if they consumed fewer eggs, the same, or more eggs than prior to becoming pregnant. Participants were also asked to report if they consumed any traditional egg drinks, such as *licuados* or *ponche*. *Licuados* are shakes sometimes prepared with raw eggs, milk and fruits and typically consumed in Mexico and Central America. Thus, this question was only asked of Non-Puerto Rican Latina participants. *Ponche* is a traditional Puerto Rican drink prepared with raw egg yolk, sugar, *malta* (non-alcoholic malt beverage) or grape juice and is believed to prevent and treat anemia. This question was only for Puerto Rican participants.

The 24-hour dietary data was collected using the standardized multiple pass methodology (Gibson 2005). Each 24-hour recall was reviewed by the study coordinator every week. Culturally appropriate food models, food products, a ruler, and kitchen utensils (measuring spoons, cups and plates) were used to assess portion sizes. The majority of interviews (65.4%) were conducted at the participants' homes, which allowed the researchers to ask the participant to show them the food items consumed, as well as to clarify the actual serving sizes (e.g., egg size: extra small, small, medium, large, extra large, and jumbo). The rest of the interviews were conducted at HHC facilities (32%) and other locations, such as family or a neighbor's home (2%). A detailed description of the preparation of the egg dishes was

included, including egg size, seasonings, ingredients and method of preparation (e.g., fried, boiled, scrambled, omelet, mixed dish).

This study was a collaboration between the University of Connecticut and the Hispanic Health Council. Institutional Review Board approval from both institutions was obtained prior to the start of the study. Trained and closely supervised bilingual and bicultural interviewers from the target community conducted the survey.

Analysis

Focus groups data were transcribed verbatim in Spanish by a bilingual/bicultural interviewer, who also participated as one of the note takers in all focus groups. Transcripts were then translated to English. The final transcript included both Spanish and English text because certain Spanish phrases and descriptions are not comparable to English descriptions. Transcripts were carefully read and evaluated by the moderator, assistant moderators, and bilingual/bicultural research interviewers. This research team provided comments and feedback about the content of each focus group and contributed to the development of broad themes that were later use to develop codes and subcodes that aided the assignation of data collected (Kieffer et al. 2002; Krueger 2002; Kriska 1998). Atlas.ti Scientific Software version 4.1 was use for the analyses of the qualitative data (to code data and retrieve text for analyses).

Quantitative data were analyzed using SPSS for Windows (versions 14.0 and 15.0). Criterion for statistical significance was $p < .05$. Descriptive analyses were run to examine the frequency of egg consumption during pregnancy. Since egg frequency was predominately reported in the FFQ on a weekly basis, all time frames reported (daily, monthly, and yearly) were converted into weekly intake and reported as means ± standard deviations. Paired sample *t*-tests were conducted to examine differences in weekly mean egg intake patterns between the year prior to the pregnancy and during pregnancy for the whole sample.

The Nutrition Data System for Research (NDS-R) versions 5.0_35, 5.0 developed by the Nutrition Coordinating Center (NCC) at the University of Minnesota, School of Public Health, Minneapolis, MN was used to convert the 24-hour recalls into nutrient intakes and to estimate the contribution of eggs towards the nutrient intakes of pregnant women.

Participants were identified as egg consumers or non-egg consumers based on consumption of eggs during the previous day as reported in the 24-hour recall data. The nutrient database is programmed to categorize the number of servings into individual foods and food groups. Participants with zero egg consumption (including non-consumption of egg-containing dishes) were classified as non-consumers. Participants with egg consumption above zero in the egg food group were classified as egg-consumers. Recipes for dishes were also included in the nutrient database. Thus, any eggs consumed as part of a mixed dish were included in the analyses of egg consumption and nutrient contribution.

Chi-square cross-tabulation analysis was used to examine the association between egg consumption during the previous day and socio-demographic characteristics. The socio-demographic characteristics examined were employment status, monthly income, food assistance program participation, age, ethnicity (i.e., Latina subgroup), interview language, level of education, marital status, day of intake, and number of years the study participant had been living in the United States. Interview language, number of years living in the United States, and place of birth were included to find out if acculturation played a role on egg consumption status. Employment status and monthly income were selected to assess if socio-economic status was associated with egg consumption. Food assistance program

participation was selected to assess if participation in the WIC program was associated with egg consumption. Day of intake (week-day vs. weekend) was selected to assess if the day of the week played a role in egg consumption. Finally, age and marital status were selected to assess if participant demographic characteristics were related to egg consumption. Independent sample *t*-test analyses were conducted to compare egg consumption status by years living in the United States and participants' age.

Participants' (sub) ethnicity was included in analyses as we were interested in finding out if egg consumption status varied as a function of belonging to different Latina sub-groups. Since only a third of the study sample was of non-Puerto Rican descent, ethnicity was recoded into a dichotomous variable (Puerto Rican and Non-Puerto Rican Latinas sub-group categories). Further breakdown of this sub-group into more categories was not possible due to statistical power limitations. Specifically, non-Puerto Rican Latinas were from México (comprising 12.6% of the whole sample), Perú (6.7%), Guatemala (2.9%), Honduras (2.5%), Dominican Republic (2.5%), Colombia (1.7%), El Salvador (1.3%), Ecuador (0.8%), Uruguay (0.8%), Bolivia (0.4%), Argentina (0.4%), and Cuba (0.4%).

Of the 241 participants surveyed, 7 were dropped from the egg nutrient contribution analyses due to unreliability of their 24-hour dietary recall data. Reasons for exclusion were (1) insufficient and excessive caloric intake, (< 600 kcal and > 9,000 kcal) (n = 2); (2) recall bias (n = 1) (A participant reported on several occasions that she ate a lot of food but could not remember the foods she had consumed during the previous day); and (3) 24-hour dietary recall not completed during the day of the interview because participants decided to withdraw from the study (n = 2). Two participants lived in a shelter at the time the survey was conducted. This temporary living arrangement did not reflect their usual dietary eating behaviors. Thus, a total of 234 participants were included in the final analyses presented herein. For the final analyses of the before pregnancy egg food frequency questionnaire data, one more participant was removed because she had gastric bypass surgery during the year prior to becoming pregnant.

Results from the 24 hour recalls were expressed as the proportion of nutrient intake derived from eggs. The nutrient contribution from eggs during the previous day among egg consumers was calculated by dividing the amount of a particular nutrient coming from eggs by the total amount of that nutrient consumed during the previous day. Nutrient results were energy-adjusted to control for total food intake. Energy adjustment was calculated dividing each nutrient by the total energy intake in kcal. Frequencies and histograms were run for each nutrient to determine if the distribution for each food group was normal or skewed. If the distribution was normal, an independent-sample *t*-test was conducted to determine if mean nutrient intakes differed among egg consumers and non-consumers. If the distribution was not normally distributed, *tertiles* were developed to rank nutrient intakes. In this instance, chi-square cross-tabulation analyses were conducted to examine the association between egg consumption and nutrient intake categories.

Participants' age-adjusted nutrient intakes were compared against the following Dietary Reference Intake parameters during pregnancy: (1) Estimated Average Requirements (EARs), (2) Recommended Dietary Allowances (RDAs), and (3) Adequate Intakes (AIs) for selected nutrients (IOM 2008). Women were classified as having an inadequate intake if it was less than the EAR, less than two thirds of the RDA, or less than two thirds of the AI's.

RESULTS

Focus Groups

Comadrona focus group—A total of 5 *Comadrona* case workers participated in the focus group. Their mean age was 45 ± 9y and they had been working in the program for many years (9.2 ± 7y). All except 1 of the staff members were of Puerto Rican descent. The concepts discussed during the *Comadrona* Program focus group were (1) beliefs about eggs, (2) cost of eggs, (3) egg safety, (4) egg methods of preparation, and (5) eggs and nutrition. *Comadrona* case workers knowledge about eggs revolved around the topic of cholesterol. When asked to advise someone about how frequently they should be eating eggs, their recommendation was for people to eat eggs only once per week based on their association of eggs with cholesterol. However, this statement was qualified by a second *Comadrona* case worker who stated that her view about eggs changed after attending a training about the benefits of consuming eggs: *"I personally changed the idea or concept that I have about eggs when I attended a training about the benefits of consuming eggs. … In a study they proved that in several countries where they eat eggs all the time, they found no association with heart problems."*

When the *Comadrona* participants were asked to name some of the benefits of consuming eggs, protein content was the only benefit they discussed. They also discussed the concept of cost, including that eggs are an inexpensive food. However, they also mentioned that eggs cost more because most of the small stores accept WIC vouchers and they will charge double their cost. This can imply that non-WIC participants can be suffering from this system because they will be charged more for a carton of eggs.

Egg safety emerged as a topic of interest to the *Comadrona* case workers. *Ponche* consumption during pregnancy was viewed as a negative dietary habit because of its content of raw egg. As described earlier, *ponche* is a traditional drink consumed by pregnant Puerto Rican women that is prepared mixing grape juice or *malta* (malt beverage) with raw egg yolk and sugar. *Ponche* is believed to prevent and treat anemia among pregnant Puerto Rican women. Similarly, the focus group participants expressed concern about their clients consuming eggs "*pasado por agua*" (just passed through water) meaning they are undercooked. The following quotations reflect their concerns: *"A worry I have is that a lot of us, Puerto Ricans we take malta and mix it with raw egg to make ponche, then raw egg is not good,"* and "*We need to tell them that if they eat eggs, they also need to know to boil them because there are people, how they call it is pasado por agua … only like pass through the water for several seconds and they like the eggs that way."*

Comadrona case workers were asked to report egg methods of preparation typically used by their clients. The methods of preparation for eggs discussed were scrambled eggs, Hispanic omelet, egg potato salad, and Lipton soup with boiled eggs. They also had a discussion about eggs being consumed when beans were not available and about egg dishes typically consumed: *"Eggs in white rice when there are no beans, we Puerto Ricans do this a lot," and "I just remember arroz a la puente, which is white rice with a banana across and fried egg."*

Pregnant women focus groups—A total of 10 Puerto Rican women participated in the focus groups. Their mean age was 23 ± 6y. Mean length of stay in the United States was 12 ± 8y. This was the first pregnancy for half of the participants. When pregnant participants were asked if they thought pregnant women should eat eggs, almost all agreed that eggs are a good source of protein. A participant stated, *"Egg is good because it has protein, I take the yellow part out, but sometimes I eat it, if I want to eat 4 or 5 eggs, I will try to take out at yellow part of at least 3 of them because that has cholesterol. I will eat the white part that is*

the protein." However, participants failed to mention other important nutrients found in eggs.

All participants agreed that eggs are an important food that forms part of the Puerto Rican culture. The methods of egg preparation used by this ethnic group are scrambled, omelet, fried, and as part of a mixed dish such as: potato salad and Lipton soup (with a boiled egg). Other methods are expressed in the following quotations: *"Tortillas de huevos (egg omelet), you add cheese, ham, whatever you want,"* and *"Fried eggs … boiled eggs."*

Participants also agreed that eggs are not only eaten at breakfast, but sometimes are eaten when they do not want to eat meat or when meat is not available to eat in the house: *"Sometimes instead of eating a piece of meat, sometimes, I make an egg instead of meat."* Another participant followed, *"with rice"* (referring to the popular Puerto Rican dish, fried egg, on top of white rice which is typically consumed when there isn't money for meat).

When participants were asked about the beverage called *ponche*, participants reported that *ponche* was made with raw egg yolk, sugar and Welch's grape juice or *malta*. However, they also reported that some people make it with coffee. The reasons for drinking *ponche* were also discussed. A participant stated, *"I always drink it. I have anemia very low,"* (referring to low hemoglobin levels). Another participant said that she had heard of *ponche* in the past but did not prepare it because she also heard that was harmful. When asked why she thought it was harmful she responded *"One time I heard that the yellow part is harmful, I don't know."*

When participants were asked if there was a particular time during pregnancy they should be eating more eggs, their answer was during the first three months because this is when they need most vitamins. Some participants were concerned about potential risk associated with egg consumption: *"In my family there are a lot that suffer from cholesterol, so when I hear them say oh I can't eat eggs, there are certain limits to consume certain things to avoid high cholesterol, so that is why I said I do not like to eat a lot."*

Dietary Intake Study

Participants' characteristics—Participants' mean age was 24.6 ± 5.5y. Almost one third of the interviews were conducted in Spanish, and 58% of the women were in their second pregnancy trimester. Participants had a low level of education and a low economic status, and 55% did not have a partner. Eighty-four percent of the participants were enrolled in the WIC program. Since 67% of the sample identified themselves as Puerto Ricans and 33% as Non-Puerto Ricans, Latinas were dichotomized into 2 categories: Puerto Ricans and Non-Puerto Rican Latinas.

Food Frequency Questionnaire

Ninety-six percent (n = 226) of the women reported consuming eggs during pregnancy. Their mean egg consumption was 3.4 ± 3.3 times per week. Forty-three percent (n = 90) consumed eggs between 1 and 3 times per week, 34% (n = 70) between 3 to 5 times per week, and 23% (n = 48) consumed eggs ≥ 5 times per week. Participants' egg preparation preferences were scrambled without cheese (55.2%), hard boiled (yolk fully cooked) (46.7%), omelet (44.1%), scrambled with cheese (43.7%), fried (runny or sunny side up) (41.4%), fried (well-cooked) (35.0%), and hard boiled (*"pasado por agua,"* yolk not fully cooked) (11.0%). Study participants also reported consuming eggs with ham (35.4%), sausages (27.3%), and bacon (23.2%).

There were no significant differences in the weekly consumption of eggs during the year prior to becoming pregnant and during pregnancy, except for egg sandwiches from fast food

restaurants which were consumed on average more frequently during pregnancy (1.1 ± .54 vs. 0.75 ± 0.57 times per week, respectively, $p = .004$). During the 2 reference time periods, the majority of study participants consumed large size eggs (52.1%) (n = 125), which is consistent with the egg size allowed by the WIC program. Sixty-seven percent (n = 160) reported buying for their household at least a dozen eggs and 32.5% (n = 78) more than a dozen at a time. The frequency for buying eggs in the household was 31.8% (n = 78) once per week, 12.4% (n = 29) twice per week, 24.5% (n = 57) two times per month, 9.8% (n = 23) more than twice per month, and 14.6% (n = 34) once per month. The rest of participants did not know or reported a combination of the ones above (one time per month and sometimes more than one time per month).

Egg Consumption and Beliefs

About one-third (34%, n = 82) of the participants reportedly consumed more, 28.2% (n = 67) consumed less, and 34.9% (n = 83) consumed eggs with the same frequency as before becoming pregnant. Among Puerto Rican participants consuming *ponche* (n = 28), the most common reason given for drinking it was the belief that it improves hemoglobin levels or treats anemia (65%). Other reasons given for drinking *ponche* were that it was recommended by a family member or that it is part of their culture (11.5%), or that it is a good source of energy and vitamins (15.4%).

Overall, 91% reported not being aware of health risks associated with raw egg consumption during pregnancy, 2.1% (n = 5) stored eggs at room temperature, and 0.9% (n = 2) stored eggs at room temperature and in the refrigerator. Eleven percent (n = 25) reported being sick after eating food during pregnancy (not due to pregnancy-related symptoms, such as morning sickness). When asked the type of food causing the sickness, only one person related her sickness to a dish prepared with eggs (*tortitas de harina, huevo y canela*, or white flour, egg, and cinnamon pancakes). The rest attributed food illness to the consumption of rice with peas, barbecue ribs, fish, pork (pork chops, fried pork ring, intestines), turkey, milk, lasagna, chicken with alfredo sauce, and foods consumed at fast food restaurants (hamburgers, Chinese rice, burrito).

24-hour Recall

There were no significant differences for most of the participants' demographic and socio-economic characteristics by egg consumption status based on the 24-hour recall data (consumers vs. non-consumers). However, non-egg consumers were more likely to receive food stamps than egg consumers, 56.1% vs. 41.4%, respectively ($p < .05$) (Table 3). Since there were no significant differences in Latino sub-group categories and egg consumption status, all pregnant Latinas were grouped together for the final analyses examining the nutrient contribution from eggs.

Forty-seven percent (n = 111) of the pregnant Latina participants consumed eggs during the previous day. Participants' 24-hour recall egg preparation methods were fried eggs (26%), mixed dishes (23%), scrambled eggs (23%), boiled eggs (7%), omelet (4%), and a combination of methods among participants who consumed eggs two times during the previous day and used different cooking methods (14%). The remaining 3% could not remember how their eggs were prepared.

The following mixed egg-containing dishes were consumed during the previous day by the study participants: egg sandwiches, egg potato salad, egg rolls, manicotti, meatballs, calzone, *tamal* (Hispanic dish based on corn meal stuffed with meat, dried fruit, olives and/or green pepper and wrapped in a corn husk), Chinese rice, Hot Pockets, cupcakes, *cuernitos*

(Hispanic croissant), *rellenos de papa* (potato fritters stuffed with pork or beef), Salisbury steak, and *licuado* (shake prepared with eggs, fruit, and/or milk).

Nutrient Contribution from Eggs towards the Overall Diet of Pregnant Latinas

Among egg consumers, eggs contributed 11% of total kcal, 20% of fat, 17% of total protein (the sum of the animal and vegetable protein), and 24% of animal protein (protein from animal products, including meat, eggs, and dairy foods) daily intakes. For water-soluble vitamins, eggs contributed 21% of riboflavin, 23% of pantothenic acid, 27% of vitamin B_{12}, and 13% of folate daily intakes. For fat-soluble vitamins, eggs contributed 21% of vitamin A, 29% of vitamin D, 23% of vitamin E, and 17% of vitamin K. Eggs also contributed 16% of phosphorous, 14% of zinc, 25% of selenium, and 12% of iron intakes. Eggs contributed 35% of lutein and zeaxanthin, and 63% of the deco-hexanoic acid (DHA). Eggs also contributed 61% of the cholesterol consumed during the previous day.

After adjusting each nutrient for total energy intake, nutrient intakes of total protein, animal protein, and fat were significantly higher among egg consumers than non-consumers (Table 4). Egg consumers had significantly higher energy-adjusted vitamin K, vitamin E, selenium, beta carotene, and lutein and zeaxanthin intakes when compared to non-consumers (Table 5). Energy-adjusted cholesterol, total polyunsaturated fatty acids, and DHA were also significantly higher among egg consumers. Egg consumers were more likely than non-consumers to have adequate intakes of protein, copper, selenium, riboflavin, pantothenic acid, vitamin B_{12}, and vitamin K (Table 6).

DISCUSSION

Focus groups were very effective for identifying positive as well as potentially harmful egg consumption beliefs and practices and provided essential information leading to the development of a culturally appropriate egg FFQ for this study. Focus group participants reported consuming *ponche* and eggs *pasado por agua*. Because both involve the use of raw or undercooked eggs it is important that the community becomes aware of the potential food safety risk associated with these dietary choices (Bermúdez-Millán et al. 2004).

Our study indicates that eggs make an important contribution to the diet of pregnant Latinas regardless of sub-ethnicity. Furthermore, egg consumption overall did not change and actually increased for specific food items such as egg sandwiches as a result of pregnancy. This suggests that Latinas do not experience aversion to eggs during pregnancy, nor that they have cultural beliefs against egg consumption during pregnancy. This is consistent with findings from George and others (2005) who documented, in a multi-ethnic sample of low-income women (30% white, 24% African American, and 46% Hispanic), significantly higher intake of eggs during pregnancy than after the birth of the child.

Results from our study demonstrate that egg intake contributes significantly towards the diet and nutrient intakes of pregnant Latinas. These include omega-3 fatty acids (e.g., DHA) as well as essential vitamins and minerals, all of which are key for the proper growth and development of the offspring. For example, research continues to support a role for omega-3 fatty acids in the proper neurological development of the fetus and child (Makrides 2008). These findings are fully consistent with the fact that eggs are a good source of at least 11 essential nutrients (Hasler 2000). Similar to our study, Song and Kerver (2000) found that eggs were an important contributor to nutrients in the diets of Americans. Eggs contributed significantly to the intake of several essential nutrients, even after adjusting for energy intake. This suggests that the nutrient intake differences observed in our study are explained, at least in part, by the high nutrient density of eggs. Indeed other researchers have also

concluded that the nutrient density of eggs makes them a valuable contributor to the overall nutritional balance of the American diet (Applegate 2000).

Egg consumption has been positively associated with pregnancy outcomes. However it is important to acknowledge that recent large prospective epidemiologic studies conducted in the US have found an increased risk of type 2 diabetes among both men and women with a high intake of eggs (i.e., at least once per day) perhaps as a result of impaired glucose metabolism and insulin resistance (Djoussé et al. 2009).Thus, in the case of women of reproductive age it may become important that future studies help understand their health risks involved with frequent egg consumption in relationship to the potential health benefits to the offspring. In our study, women consumed eggs about three times per week so it is unlikely that this level of intake would have been associated with negative maternal health outcomes.

Study Limitations

This study has several limitations. Eggs are a rich source of choline, which is a nutrient critical for the brain and memory development in *utero* and early in life, and thus are recommended during pregnancy as a rich source of choline (Zeisel 2004). Our study was not able to examine choline because this compound was not included in the nutrient database. However, one large egg contains 125 mg of choline and the daily recommendation of this nutrient for pregnant women is 450 mg, therefore we can conclude that eggs did contribute significantly to the choline intake of our study participants.

In this study, we used a food frequency questionnaire to document changes in egg consumption patterns the year before and during pregnancy. Because the period that had to be recalled was long it is possible that memory recall errors are present in our study. However, if women had experienced aversion to eggs during pregnancy for physiological or cultural reasons, our FFQ would have been able to document it. The fact that the findings from the FFQ was totally consistent with the focus groups results gives us confidence in our conclusion that egg consumption is widespread among Latinas and that this pattern is not disrupted during pregnancy.

Nutrient intake patterns as a function of egg consumption status were assessed based on a single 24-hour recall. Multiple 24-hour recall per individual would have given us a more precise estimation of usual dietary intake patterns; however the results strongly indicate that the days that women consume eggs their nutrient intake profiles are significantly improved in a way that is fully consistent with the nutrient content of eggs.

The statistical analyses were cross-sectional and thus can not contribute to our understanding as to if and how dietary intake patterns, and egg consumption in particular change as a function of pregnancy trimester. Changes in dietary intake patterns at different points during pregnancy is an area of research that needs to be prioritized in future studies (IOM 2009).

Another potential limitation of this study is that we were not able to examine the nutrient contribution from prenatal supplements because participants had difficulties reporting the brand and type of prenatal supplement that they were taking. Lastly, because of sample size limitation we were not able to disaggregate the non-Puerto Rican Latinas into sub-groups limiting our ability to further understand if there were more subtle dietary intake practice differences in this heterogeneous group.

CONCLUSION

Egg consumption is a common dietary practice among low-income pregnant Latinas, contributing significantly to their overall nutrient intakes and nutrient density of their diets.

The WIC Program provides vouchers to pregnant women earmarked to buy eggs, among other supplemental food items. As previously discussed, recent changes in WIC policies may lead to lower access to eggs by pregnant and postpartum women (IOM 2005). This policy change on total egg consumption and pregnancy outcomes deserves further study.

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ABBREVIATIONS

EAR	Estimated Average Requirement set by the Food and Nutrition Board
RDA	Recommended Dietary Allowance set by the Food and Nutrition Board
AI	Adequate Intake set by the Food and Nutrition Board
WIC	Supplemental Nutrition Program for Women, Infants and Children
CEHDL	Connecticut NIH EXPORT Center of Excellence for Eliminating Health Disparities among Latinos
NIH	National Institutes of Health
PUFA	Polyunsaturated Fatty Acids
DHA	Docosahexaenoic acid

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TABLE 1

Focus Groups Question Guide

A.	Focus Group # 1 Question Guide: *Comadrona* Program Staff
	Do you think pregnant women should consume eggs during their pregnancy?
	What are the reasons for eating (or not eating) eggs during pregnancy? Are you aware of any benefits of eating eggs during pregnancy? Is there a particular time during a woman's pregnancy when you think she should consume more eggs? Or less? Do you think that our culture consumes eggs often or not? What do you think the reasons are for this? Eggs methods of preparation?
B.	Focus Groups #2 and #3 Questions: Pregnant Women
	Do you consume eggs? How do you prefer to eat your eggs?
	Do you think pregnant women should consume eggs during their pregnancy?
	What are the reasons for eating (or not eating) eggs during pregnancy?
	Are eggs good or bad for you? Are you aware of any benefits of eating eggs during pregnancy? Is there a particular time during a woman's pregnancy when you think she should consume more eggs? Or less?
	Do you think that our culture consumes eggs often or not? What do you think the reasons are for this? Is there a particular food that you buy at the supermarket or local bakery that you might think it includes eggs? Is there a particular food that includes eggs as part of the recipe that you usually make at home?

TABLE 2

Egg Food Frequency Module*

I am now going to ask you questions about foods that you have eaten SINCE YOU BECAME PREGNANT. For each food, I want to know whether you EAT it (yes or no), and also approximately how many times you EAT it, (times per day, week, month).

Since you became pregnant	Do you eat …	# times	How often do you eat it?
Eggs (overall)	Y / N	___	d w m
1) Scrambled eggs	Y / N		
1) Without cheese	Y / N	___	d w m
2) With cheese	Y / N	___	d w m
2) Fried eggs	Y / N		
1) Runny/yolk not cooked	Y / N	___	d w m
2) Well done	Y / N	___	d w m
3) Boiled eggs	Y / N		
1) Runny/yolk not cooked	Y / N	___	d w m
2) Hard	Y / N	___	d w m
4) Egg omelet	Y / N	___	d w m
5) *Huevos rancheros* (fried egg, served on top of a tortilla)	Y / N	___	d w m MEXICANS
6) Eggs with bacon; scrambled, boiled or fried (underline all that apply)	Y / N	___	d w m
7) Eggs with sausages; scrambled, boiled or fried (underline all that apply)	Y / N	___	d w m
8) Eggs with ham; scrambled, boiled or fried (underline all that apply)	Y / N	___	d w m
9) *Licuados* (drink prepared w/raw eggs)	Y / N	___	d w m CENTRO AND MEXICAN AMERICANS
10) *Ponche* (drink prepared w/raw eggs)	Y / N	___	d w m PUERTO RICANS
11) Others: Egg sandwich from fast food restaurants; flan (custard); egg potato salad			

* Food frequency was also asked for the time period: during the year before you became pregnant (as times per day, week, month, or year).

TABLE 3

Participants' Demographic Characteristics by Egg Consumption Status

	Total sample		**Egg consumers[1] (n = 111)**		**Non-consumers[1] (n = 123)**		
	N		**Mean ± SD**		**Mean ± SD**		***p* value[2]**
Participants' age (years)	234		24.6 ± 6y		24.7 ± 5y		.494
Number of years living in the U.S.	233		10.5 ± 9y		12.9 ± 9y		.785
	N	%	N	%	N	%	*p value[3]
Ethnicity[4]							
Puerto Ricans	158	67.5	70	63.1	88	71.5	.167
Non-Puerto Rican Latinas	76	32.5	41	36.9	35	28.5	
Interview language							
Spanish	159	67.9	78	70.3	81	65.9	.470
English	75	32.1	81	29.7	42	34.1	
Education							
High school or less	191	81.6	89	80.2	102	82.8	.588
≥ High school	43	18.4	22	19.8	21	17.1	
Day of intake							
Weekday (Monday–Friday)	203	86.8%	94	84.7%	109	88.6%	.376
Weekend (Saturday and Sunday)	31	13.2%	17	15.3%	14	11.4%	
Food stamp program participation (yes)	115	49.1%	46	41.4%	69	56.1%	.023*
WIC program participation (yes)	196	83.8%	93	83.8%	103	83.7%	.993

[1] Participants were identified as egg consumers if they consumed eggs during the previous day and as non-consumers if they did not consume eggs during the previous day.

[2] Independent sample *t*-test, 2-tailed (95% CI).

[3] Chi-square cross-tabulation bivariate analyses.

[4] Non-Puerto Rican Latinas consisted of people from México (12.6%), Perú (6.7%), Guatemala (2.9%), Honduras (2.5%), Dominican Republic (2.5), Colombia (1.7%), El Salvador (1.3%), Ecuador (0.8%), Uruguay (0.8%), Bolivia (0.4%), Argentina (0.4%), and Cuba (0.4%).

* Significance level at $p < .05$.

TABLE 4

Energy-Adjusted Nutrient Intakes as a Function of Egg Consumption Status (n = 234)

Nutrient	Consumers†	Mean ± std dev	*p value[3]
Total protein[1] (grams)	Egg consumers	.036 ± .007	.011*
	Non-consumers	.034 ± .009	
Animal protein[2] (grams)	Egg consumers	.025 ± .007	.020*
	Non-consumers	.022 ± .010	
Fat (grams)	Egg consumers	.036 ± .010	.017*
	Non-consumers	.033 ± .009	

†Data derived from a single 24-hour dietary recall. Egg consumers (n = 111) and Non-consumers (n = 123) during the previous day. Energy adjustment was calculated dividing each individual nutrient by the total energy intake in kcal.

[1]Total protein is the sum of animal and vegetable protein.

[2]Animal protein is the protein from animal products, including meat, eggs and dairy foods.

[3]Independent sample *t*-test analyses were used to compare the mean energy-adjusted nutrient intakes between egg consumers and non-consumers (two-tailed). Nutrient contribution from prenatal supplements not included.

*Significance level at $p < .05$.

TABLE 5

Energy-Adjusted Nutrient Intakes as a Function of Egg Consumption Status (n = 234)

Nutrient	Consumers†	*Tertile 1*[1]	*Tertile 2*[1]	*Tertile 3*[1]	**p* value[2]
Vitamin K (mcg)	Egg consumers	27.9	30.6	41.4	.039*
	Non-consumers	38.2	35.8	26.0	
Vitamin E (mg)	Egg consumers	24.3	36.0	39.6	.017*
	Non-consumers	41.5	30.9	27.6	
Selenium (mg)	Egg consumers	23.4	31.5	45.0	.001*
	Non-consumers	42.3	35.0	22.8	
Beta-carotene (mcg)	Egg consumers	27.0	31.5	41.4	.032*
	Non-consumers	39.0	35.0	26.0	
Lutein and zeaxanthin (mcg)	Egg consumers	18.9	39.6	41.4	.000*
	Non-consumers	46.3	27.6	26.0	
Cholesterol (mg)	Egg consumers	4.5	28.8	66.7	.000*
	Non-consumers	59.3	37.4	3.3	
Polyunsaturated fatty acids	Egg consumers	25.2	36.0	38.7	.039*
(PUFA) (g)	Non-consumers	40.7	30.9	28.5	
Docosahexaenoic acid	Egg consumers	4.5	44.1	51.4	.000*
(DHA) (g)	Non-consumers	59.3	23.6	17.1	

†Data derived from a single 24-hour dietary recall. Egg consumers (n = 111) and Non-consumers (n = 123) during the previous day. Energy adjustment was calculated dividing each nutrient by the total energy intake in kcal.

[1]Values represent the percent of the sample falling within each tertile. Tertiles were constructed based on the energy-adjusted nutrient and its normal distribution. Categories reported as percent distribution. Cut-off points: Vitamin K *(phylloquinone)*: Tertile 1 = 0 thru .012, Tertile 2 = .012 thru .023, Tertile 3 = .023 thru .19; Vitamin E *(alpha tocopherol)*: Tertile 1 = 0 thru .002, Tertile 2 = .002 thru .003, Tertile 3 = .003 thru .011; Selenium: Tertile 1 = 0 thru .048, Tertile 2 = .048 thru .057, Tertile 3 = .057 thru .099; Beta-carotene: Tertile 1 = 0 thru .21, Tertile 2 = .21 thru .70, Tertile 3 = .70 thru 46; Lutein and xeaxanthin: Tertile 1 = 0 thru .25, Tertile 2 = .25 thru .49, Tertile 3 = .49 thru 2.7; Cholesterol: Tertile 1 = 0 thru .085, Tertile 2 = .085 thru .18, Tertile 3 = .18 thru .54; PUFA: Tertile 1 = 0 thru .005, Tertile 2 = .005 thru .007, Tertile 3 = .007 thru .023; DHA: Tertile 1 = 0 thru .000005, Tertile 2 = .000005 thru .00002, Tertile 3 = .00002 thru .0003.

[2]Chi-square cross-tabulation bivariate analyses were used to compare the energy adjusted nutrient distribution between egg consumers and non-consumers (two-tailed). Nutrient contribution from prenatal supplements not included.

*Significance level at $p < .05$.

TABLE 6

Nutrient Intake Adequacy among Pregnant Latinas[1–3] (n = 234)

	Egg consumers[†]		Non-consumers[†]		
Nutrient	**n[4]**	**%[5]**	**n**	**%**	***p* value[6]**
Total protein					
<EAR[1]	6	5.4	23	18.7	.002*
≥ EAR	105	94.6	100	81.3	
Copper					
<EAR	15	13.5	31	25.2	.025*
≥ EAR	96	86.5	92	74.8	
Selenium					
<EAR	1	.9	8	6.5	.026*
≥ EAR	110	99.1	115	93.5	
Riboflavin					
< RDA[2]	2	1.8	8	6.5	.076
≥ RDA	109	98.2	115	93.5	
Vitamin B12					
< RDA	10	9.0	21	17.1	.069
≥ RDA	101	91.0	102	82.9	
Pantothenic acid					
< AI[3]	17	15.3	44	35.8	.000*
≥ AI	94	84.7	79	64.2	
Vitamin K					
< AI	61	55.0	90	73.2	.004*
≥ AI	50	45.0	33	26.8	

[†]Data derived from a single 24-hour dietary recall. Egg consumers (n = 111) and Non-consumers (n = 123).

[1]EAR is estimated Average Requirement set by the Food and Nutrition Board.

[2]RDA is the Recommended Dietary Allowance set by the Food and Nutrition Board.

[3] AI is the Adequate Intake set by the Food and Nutrition Board.

[4] Number of subjects with intake for particular nutrient being < or ≥ EAR or 70% RDA.

[5] Rows add to 100% based on nutrient intake being < or ≥ EAR or 70% RDA.

[6] Chi-square cross-tabulation bivariate analyses were used to determine the difference between those with less or more than recommended intake. Nutrient contribution from prenatal supplements not included.

[*] Significance level at $p < .05$.