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Quality of Shrimp Available to Consumers in Arkansas

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The Food and Drug Administration (FDA) has not set standards for the bacteriological and chemical quality of fresh shrimp sold by retailers, but it is currently developing the criteria and methods needed for such evaluation (Sloan and Hagen, 1992). These efforts have resulted from national attention being focused on seafood quality and the dangerous lack of regulation in the seafood industry. However, several published studies have suggested acceptable levels of bacterial and chemical parameters to be used in determining seafood quality (Cobb and Vanderzant, 1975; Matches, 1982; Shamshad et al., 1990). This study utilizes these recommendations in investigating the quality of "fresh" shrimp available to Arkansas consumers.

Quantities of shrimp (454 g) were purchased from retail outlets throughout the state. After transport (30-45 min) to the laboratory on ice, the tail, shell and exposed anterior tissue were removed and discarded. The remaining muscle tissue was divided into 10 g (wet weight) amounts and held at approx. 20°C until analyses were carried out on the same day.

Total aerobic bacteria were enumerated from a homogenate of 10 g of shrimp and 90 ml diluent (0.1% Bacto Peptone, 0.9% NaCl) by spread plating on tryptone soy agar (Difco). All colony forming units (cfu) were counted after 48 h incubation at 25°C (Shamshad et al., 1990). Triplicate counts were performed on each sample and a mean determined. Plates with more than 200 cfu were recorded as too numerous to count (TNTC).

The pH was determined for homogenate of 10 g of shrimp and 20 ml of chilled (4°C) distilled, sterilized water (Shamshad et al., 1990). Two measurements were performed and the median recorded for each sample.

Retail vendors tended to display shrimp either frozen (approx. 20°C), or on ice (approx. 0°C), or refrigerated (approx. 10°C). For analysis, the date were grouped accordingly.

Shamshad et al. (1990) determined a mean number of bacteria for fresh shrimp to be 5.0×10^5 cfu/g. Increases in bacterial counts were proportional to storage time and temperature, reaching 3.5×10^7 cfu/g after 16 days at 0°C which was recommended as the limit of acceptability for human consumption. Acceptable limits for bacterial numbers have not been determined by the FDA (Sloan and Hagen, 1992), but elevated levels in sea water and

other shellfish (oysters, clams, muscles and crabs) have been declared a health hazard (FDA Compliance Policy Guides #7108.25 and #7119.12, 1989).

Of the 34 samples analyzed during this study, only 12 (35%) were found to be below the suggested upper limit for total aerobic bacteria (Table 1). The best quality was found for shrimp kept uniformly frozen. Six of nine frozen samples (66.7%) were found to be below the acceptable limit suggested for total bacteria. Shrimp held on ice decreased considerably in quality compared to those frozen. Only five of 13 samples (38.5%) were suitable for consumption. Refrigeration appeared to be the most inadequate in maintaining quality, since only one of twelve samples (8.3%) was below the recommended limit for bacterial numbers.

Table 1. Bacterial and chemical quality of fresh shrimp.

Commercial Display:	Frozen	On Ice	Refrigeration
Total Bacteria (cfu x 10⁷/g)			
Number of Samples	9	13	12
Mean	2.97	5.97	12.29
S.D.	3.08	5.03	6.78
High	11.00	19.50	28.00
Low	1.10	1.20	2.00
% Samples Acceptable*	66.7%	38.5%	8.3%
pH Value			
Number of Samples	3	4	6
Mean	7.40	7.42	7.99
S.D.	0.19	0.15	0.41
High	7.60	7.59	8.38
Low	7.24	7.25	7.27
% Samples Acceptable+	100.0%	100.0%	16.7%

* As proposed by Shamshad et al. (1990)

+ As proposed by Cobb and Vanderzant (1975)

The relationship between pH and sensory acceptability of shrimp was noted by both Shamshad et al. (1990), and Cobb and Vanderzant (1975). The initial pH of fresh shrimp increased proportionally with storage time and temperature. The acceptable pH values of fresh shrimp were from 7.05 to 7.60 (Cobb and Vanderzant, 1975). Once the pH exceeded 7.60, shrimp were rated as spoiled or unfit for consumption. Accordingly, the sweet, fishy

smell becomes a disagreeable, putrid odor and the once firm flesh deteriorates into a mushy or grainy textured mass. Fourteen samples were tested for pH. Only nine had pH values within the recommended limits (Table 1). The majority of these acceptable samples were purchased from retailers who kept the shrimp uniformly frozen (100%) or on ice (100%). The poorest quality samples were displayed in the open refrigeration section of the meat department. Only one of six samples (16.9%) kept in the refrigerator section had an acceptable pH value.

Although temperature was considered the significant variable in this study, time from harvest is another obvious variable which would affect quality. Fresh shrimp decompose to a point considered unsuitable in a matter of days, even when kept frozen. Matches (1982) determined that frozen shrimp will become unfit for consumption in as little as 11 days after being harvested. However, information regarding time from harvest was unattainable from most of the retailers.

The study indicated a need for regulation of storage temperature at or below 0°C until the product reaches the consumer. Excessive numbers of bacteria are considered unacceptable, but do not always indicate spoilage. However, high bacterial counts in combination with high pH values suggest that product has lost some of its quality and may not be suitable for human consumption. This study indicated, in contrast to Shamshad et al. (1990), and Matches (1982), and Cobb and Vanderzant (1975), that pH and bacterial number as measurements of quality did not always agree. Only 25% of the samples had acceptable bacterial numbers, but 64% of the samples had an acceptable pH. According to the literature, the percentage of acceptable samples in terms of bacteria counts and pH should be nearly the same.

Results of this study indicated that the consumer has only about one chance in four of buying "fresh" shrimp in Arkansas. However, until the FDA established guidelines for quality, these contaminated and possibly dangerous products will remain on the market.

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