



# Time and Temperature Affect Storage Stability of Rainbow Trout Fillets



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## ABSTRACT

Fresh rainbow trout fillets are highly perishable. Defining factors impacting this perishability and controls to circumvent spoilage and ensure safety are warranted. The objective of the study was to determine the stability of fresh rainbow trout fillets stored at 0 and 4.5° C for 0, 3, 6 and 9 d. Fresh fillets were packaged on styrofoam trays over-wrapped with polyvinyl chloride (PVC) film. The fillets were stored at 0 and 4.5°C for 0, 3, 6 and 9 d. Psychrotrophic counts, color and TBARS of raw fillets and shear force of cooked fillets were determined at 0 d and through 9 d storage. Psychrotrophic counts increased as temperature and storage time increased. The counts increased from 2.7 to 6.0 and from 2.9 to 8.8 log<sub>10</sub> CFU/cm<sup>2</sup> from 0 to 9 d at 0 and 4.5°C, respectively. A\*-values increased to 3 d and this value was maintained through 9 d storage. For L\*-values, there was a temperature by time interaction (p<0.05). Fillets stored at 0°C for 0 and 3 d were darker compared to all fillets stored at 4.5°C and fillets stored at 0°C for 6 and 9 days. B\*-values were higher for the fillets stored at 4.5°C than at the 0°C. Storage time did not affect b\*-value. The effect of temperature on TBARS was not statistically significant, but by 3 d storage, TBARS level were higher than at 0 d storage and this level decreased through 9 d storage. Kramer shear force was not affected (p>0.05) by storage temperature. However, this response peaked at day 6 of storage (199.0 g/g) and declined to 175.9 g/g by day 9. Establishing storage stability limits for fresh, rainbow trout fillets will facilitate development of interventions designed to optimize quality of this product.

## INTRODUCTION

Increasing consumer demand for fresh fish has necessitated the development of new technologies that effectively extend the shelf life of fish. After harvest, there is a progressive decline in initial quality due to two major processes: intrinsic chemical and physical changes, sometimes called "autolysis" and changes resulting from bacterial growth and metabolism (Haard,1992). An increase in temperature by a few degrees could increase the rate of fish spoilage.

Thiobarbituric acid reactive substances (TBARS) increased at the beginning of storage in over-wrapped rainbow trout fillets, but started to decrease quickly when the fillets became spoiled. This behavior may be due to the reaction of malondialdehyde (MDA) with protein degradation products. Psychrotrophic flora grew more quickly and exceeded 10<sup>7</sup>cfu/cm<sup>2</sup>at day 6 of storage (Gimenez and others, 2002). Channel catfish fillets stored at 4°C had highest TBARS on day 9 and these decreased by day 12 (Kim and others, 2000). Our study was conducted to obtain basic information about the storage stability of rainbow trout fillets stored at different temperatures and storage times.

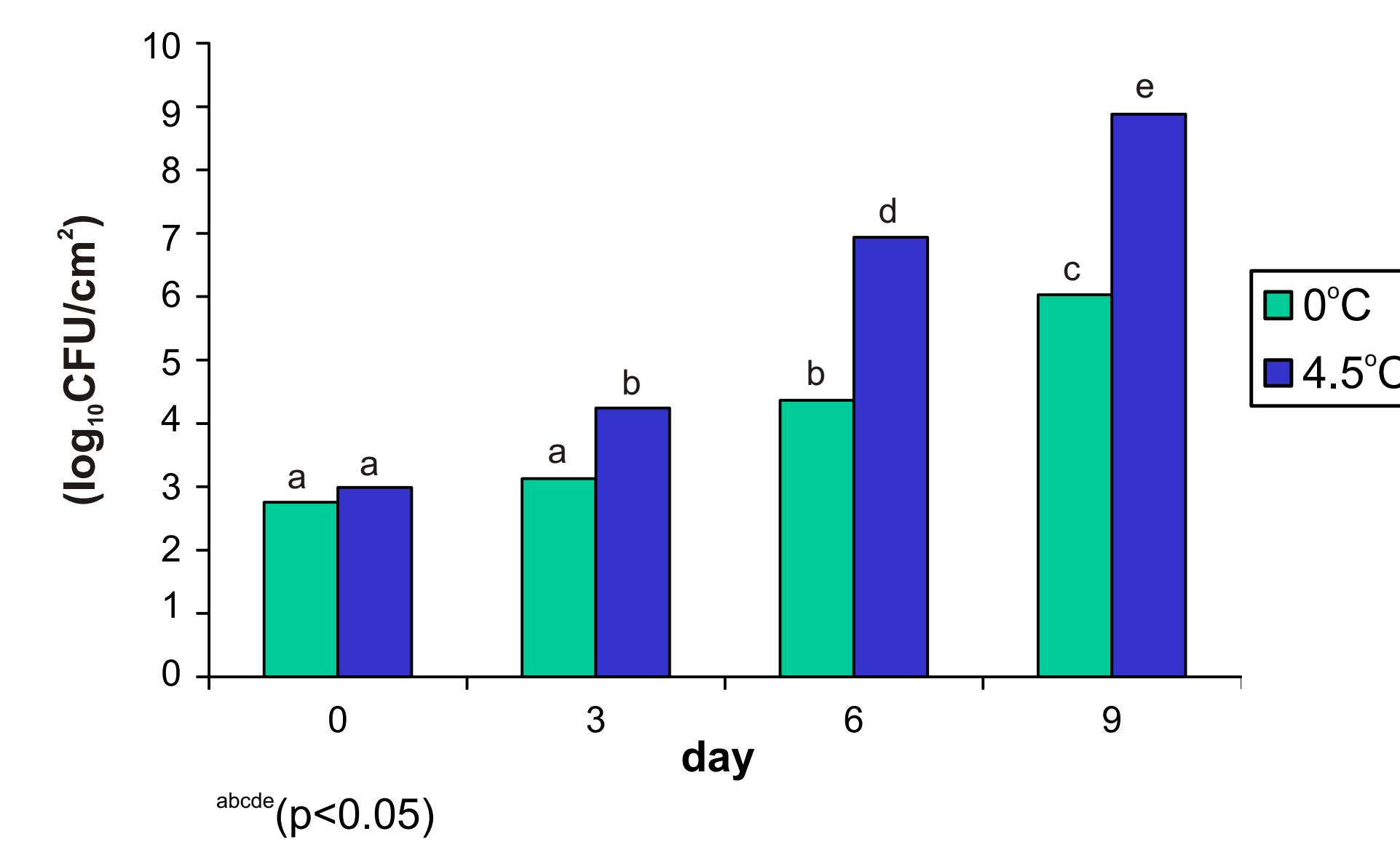
## MATERIALS AND METHODS

Fresh rainbow trout were obtained from The Conservation Funds, Freshwater Institute. Fish were immediately iced in portable coolers and transported to the laboratory. Gutting and filleting was done by hand, and fish were subsequently washed in a dilute salt / ice slurry. Fillets were drained for approximately 14-16 h at 0°C. Subsequently, fresh fillets were aerobically packed on styrofoam trays and over-wrapped with PVC. Fillets were stored in the dark at 0 and 4.5°C for 0, 3, 6, and 9 days. This experiment was replicated three times. Data was analyzed in a randomized complete block design.

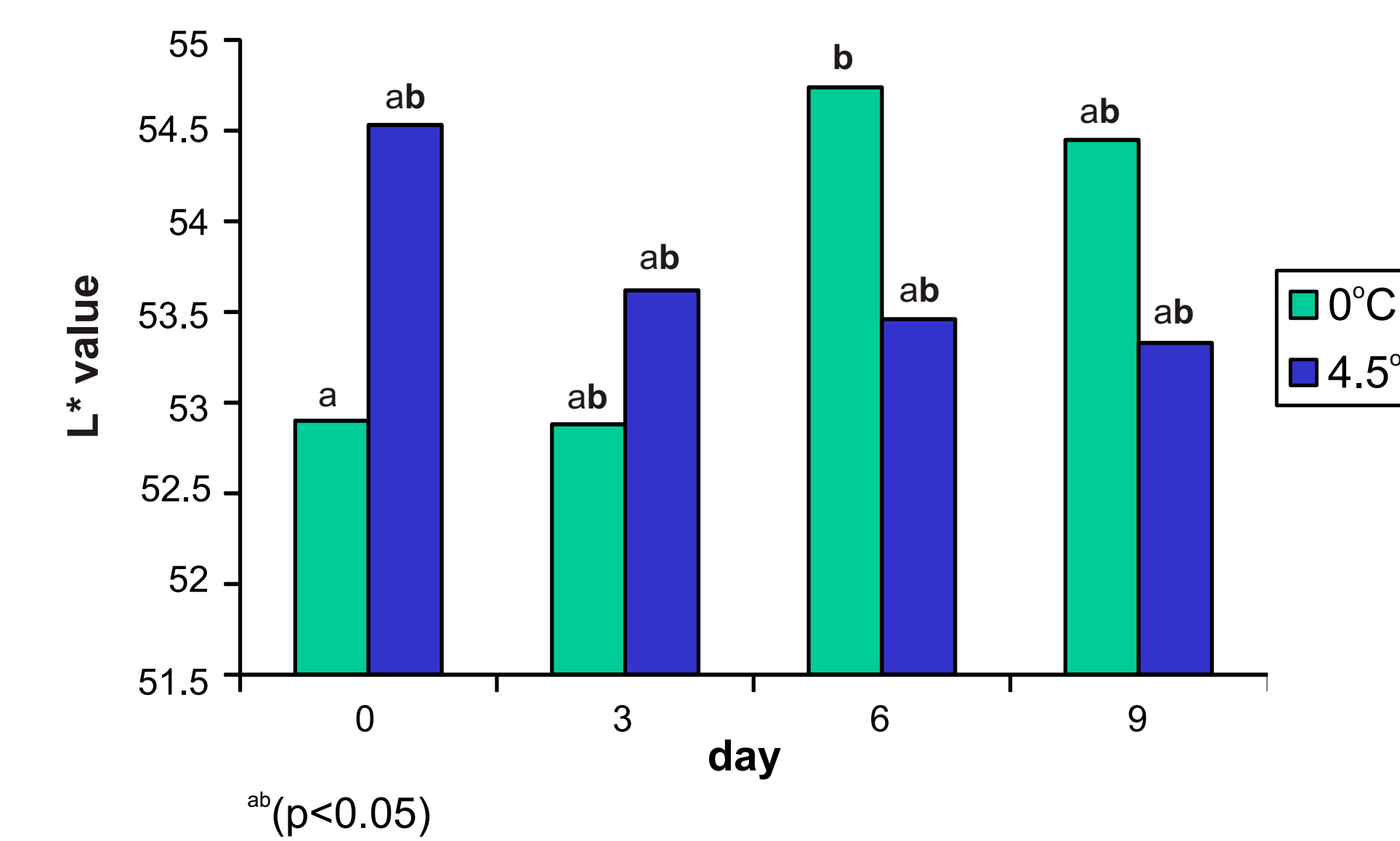
Psychrotrophic bacterial counts were determined initially and during refrigerated storage using standard procedures (APHA 1992). TBARS were determined by the 2-thiobarbituric acid method (Yu and Sinnhuber, 1957). Color L\* a\* b\* values were measured with a chromameter (Model CR-300; Minolta Camera Co. Ltd., Osaka, Japan) calibrated with a standard white plate No.21333180 (CIE L\* 93.1; a\* 0.3161; b\* 0.3326). Shear force was measured on a 3 x 8 cm strip of cooked fillet using Kramer shear attachment on a texture analyzer (Model TA-HDI, Texture Technologies Corp., Scarsdale, NY).

## RESULTS

Effect of Storage Time and Temperature on Psychrotrophic Counts of Fillets



Effect of Storage Time and Temperature on L\* value



Psychrotrophic counts increased as temperature and storage time increased. Psychrotrophic bacteria grew more quickly on fillets stored at 4.5°C than at 0°C, and significant differences were found from day 3 of storage (p<0.05). Lower L\* values for fillets stored 0 and 3 days at 0°C confirm that these fillets were darker than fillets stored at 4.5°C and fillets stored at 0°C for 6 and 9 days. Time did not affect (p>0.05) fillets stored at 4.5°C.

Effect of Temperature on TBARS, a\* value, b\* value and Shear Force

Response	Temperature (°C)	
	0	4.5
TBARS (MDA mg/Kg)	3.2 <sup>a</sup>	3.3 <sup>a</sup>
b* value	7.39 <sup>a</sup>	8.35 <sup>b</sup>
a*value	0.62 <sup>a</sup>	0.56 <sup>a</sup>
Shear force (g/g)	176.54 <sup>a</sup>	184.92 <sup>a</sup>

<sup>ab</sup>Means within a row with different superscripts are significantly different (p<0.05)

Effect of Storage Time (day) on TBARS, a\* value, b\* value and Shear Force

Response	Storage time (day)			
	0	3	6	9
TBARS (MDA mg/Kg)	0.8 <sup>a</sup>	4.3 <sup>b</sup>	4.2 <sup>b</sup>	3.7 <sup>b</sup>
b* value	7.78 <sup>a</sup>	7.39 <sup>a</sup>	8.59 <sup>b</sup>	7.70 <sup>a</sup>
a*value	0.09 <sup>a</sup>	0.64 <sup>b</sup>	0.85 <sup>b</sup>	0.80 <sup>b</sup>
Shear force (g/g)	172.84 <sup>a</sup>	175.13 <sup>a</sup>	199.03 <sup>b</sup>	175.93 <sup>a</sup>

<sup>ab</sup>Means within a row with different superscripts are significantly different (p<0.05)

**A\* values are not affected (p>0.05) by temperature. However, a\* values increased (p<0.05) to day 3 and remained higher than day 0 values through 9 days of storage. B\* values indicated that fillets stored at 0°C were less yellow (p<0.05) than fillets stored at 4.5°C. Storage temperature did not affect (p>0.05) the Kramer shear force. Whereas, storage of fillets for 6 days resulted in an increase (p<0.05) in shear force and, shear force decreased by day 9 to levels comparable to those observed at days 0 and 3.**

## CONCLUSION

Fillets stored at 4.5°C had higher psychrotrophic counts than the fillets stored at 0°C. TBARS were significantly higher on day 3 of storage. The results suggest that fresh fillets over wrapped with PVC should not be stored more than 6 days at 0°C and 3 days at 4.5°C. Basic information on the affect of temperature and storage time on storage stability of fresh rainbow trout fillets would greatly benefit its processing and other interventions to improve shelf life.

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