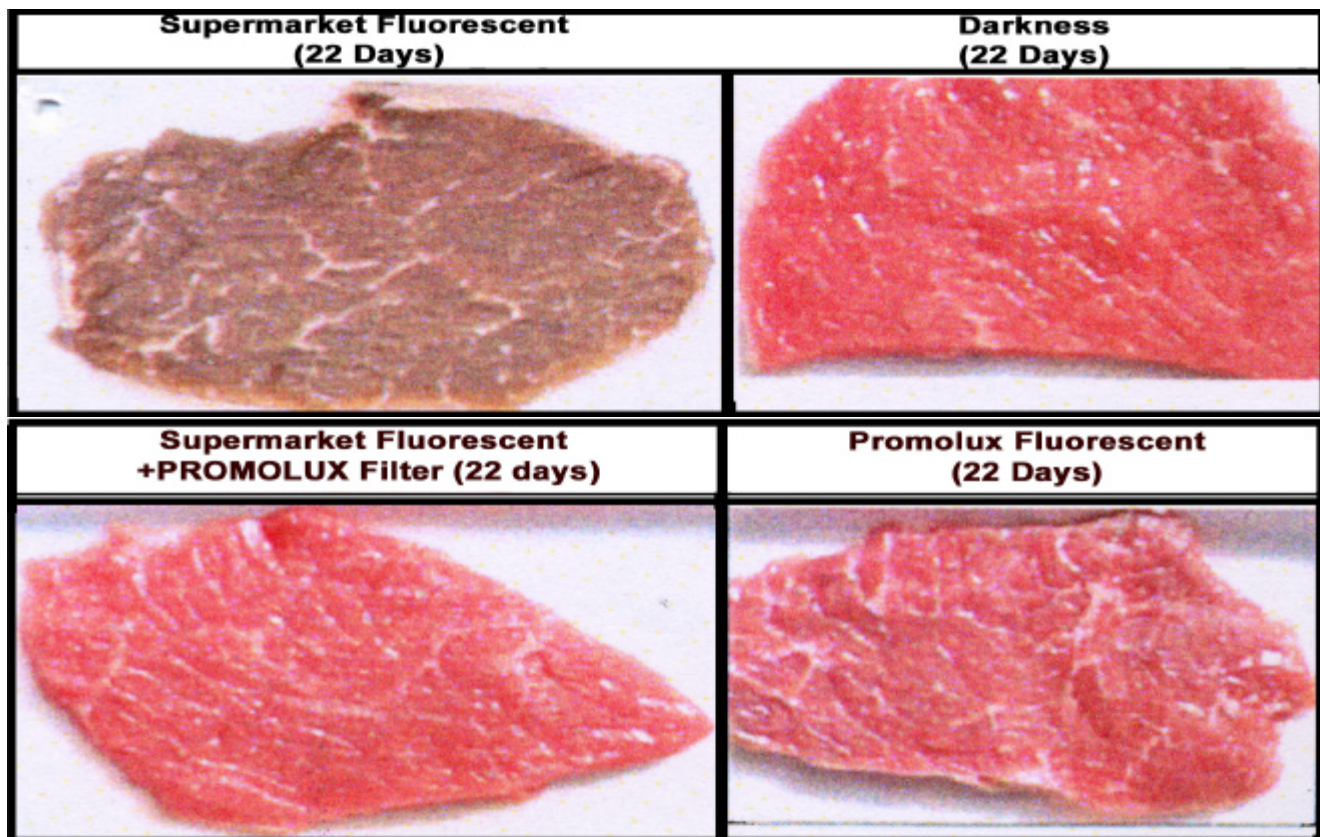


**“SHELF LIFE EXTENSION OF FRESH BEEF  
PACKAGED IN MODIFIED ATMOSPHERE  
BY VARYING LIGHTING CONDITIONS  
OF RETAIL DISPLAY”**

**Summary of research presented at the 46<sup>th</sup> International  
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## **SHELF LIFE EXTENSION OF FRESH BEEF PACKAGED IN MODIFIED ATMOSPHERE BY VARYING LIGHTING CONDITIONS OF RETAIL DISPLAY**

### **INTRODUCTION**

The display life of fresh red meat packaged in modified atmosphere (70% O<sub>2</sub> + 20% CO<sub>2</sub> + 10% N<sub>2</sub>) is influenced by the type of lighting which plays a critical role in pigment oxidation, as its energy catalyses MetMb accumulation (Renerre et al., 1993). The aim of this research was to investigate the effect of lighting conditions on the display life of fresh beef packaged in modified atmosphere. For that purpose, we compared display conditions including darkness and lighting with either a standard supermarket fluorescent, a low UV, colour balanced Promolux lamp, or the former with a Promolux polycarbonate UV Multichrome filter.

### **CONCLUSION**

The type of lighting for retail display markedly affected the shelf life of fresh beef packaged in modified atmosphere. The absence of UV radiation in display lighting, by using a Promolux lamp or a Promolux polycarbonate filter significantly extended meat shelf life. Meat colour, odour, MetMB concentration, TBA value and microbial counts were very similar of steaks displayed in darkness.

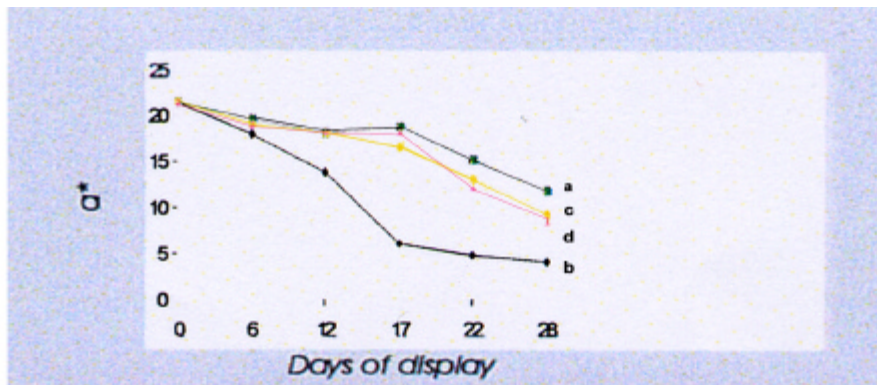


Fig 2. Values of a\* in beef steaks packaged in modified atmosphere and displayed under different lighting conditions at 1°C (34°F) Darkness (a) Supermarket fluorescent (SF) (b) SF+Promolux UV-barrier & Filter(c) Low UV colour balanced PROMOLUX lamp (d).

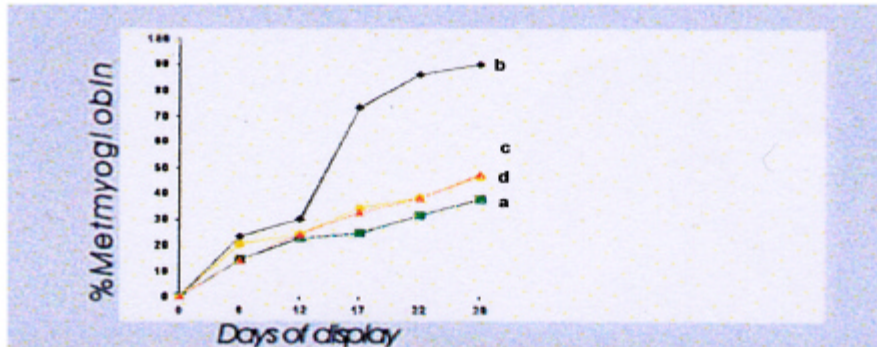


Fig 3. Metmyoglobin percentage in beef steaks packaged in modified atmosphere and displayed under different lighting conditions at 1°C (34°F) Darkness (a) Supermarket fluorescent (SF) (b) SF+Promolux UV-barrier & Filter (c) Low UV colour balanced PROMOLUX lamp (d).

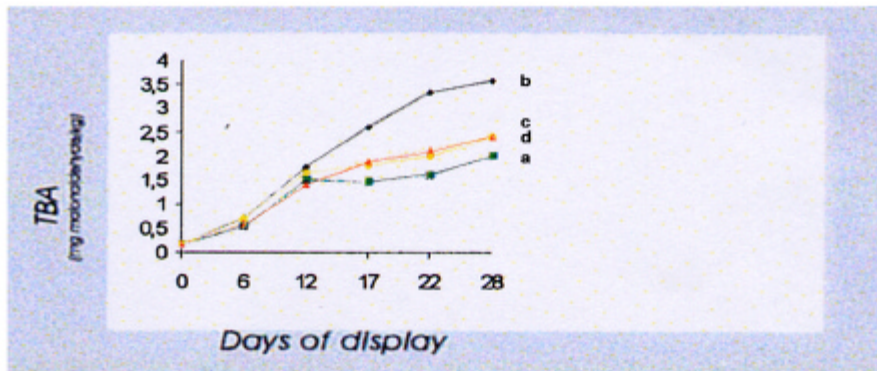


Fig 4. TBA values (mg malonaldehyde/kg) in beef steaks in modified atmosphere and displayed under different lighting conditions at 1°C (34°F) Darkness (a) Supermarket fluorescent (SF) (b) SF+Promolux UV-barrier & Filter (c) Low UV colour balanced PROMOLUX lamp (d).

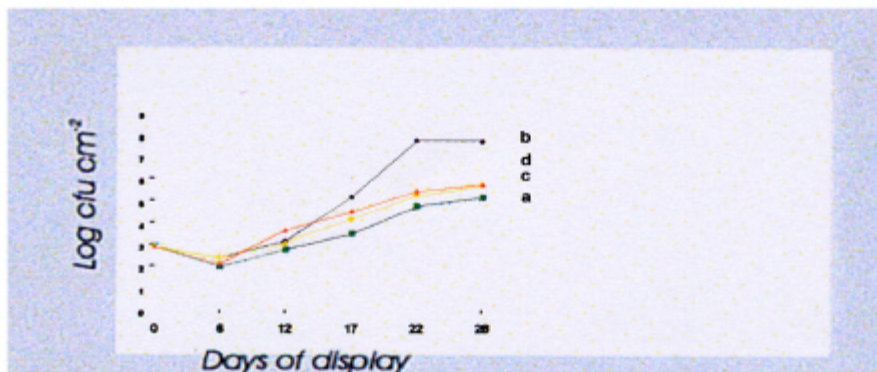


Fig 5. Counts in psychrotrophic aerobes in beef steaks packaged in modified atmosphere and displayed under different lighting conditions at 1°C (34°F) Darkness (a) Supermarket fluorescent (SF) (b) SF+Promolux UV-barrier & filter (c) Low UV colour balanced PROMOLUX lamp (d).

## RESULTS

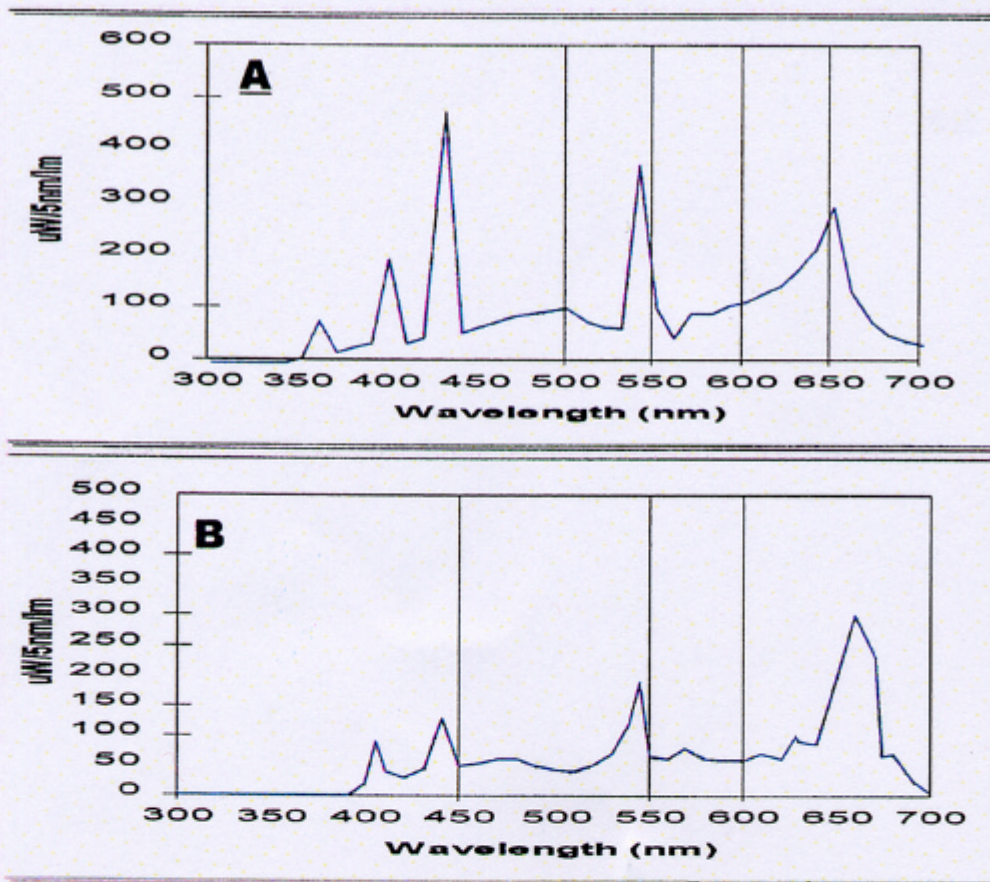


Fig 1. Emission spectra of: A) Supermarket fluorescent (Mazdafluor Phillips Superaviva TF/36W) B) Low UV colour balanced Promolux lamp.

Tab 1. The effect of odour scores in beef steaks packaged in modified atmosphere during retail display at 1°C (34°F).

	Type of lighting	Days of Display					
		0	6	12	17	22	28
<b>Odour quality*</b>	Darkness	1	1	1	1	1	2
	Supermarket Fluorescent (SF)	1	1	2	3	5	5
	SF+Promolux UV Barrier & Filter	1	1	1	2	2	2
	Low UV, colour balanced Promolux Lamp	1	1	1	2	2	2

\*1 = Excellent (not different from fresh meat), 2 = Good, but slightly poorer than fresh meat, 3 = Acceptable, 4 = Hardly Acceptable as Fresh Meat, 5 = Not Acceptable.

# **MATERIAL AND METHODS**

Muscles Longissimus dorsi was removed from beef carcass at 48 hours post slaughter and trimmed of external fat. Steaks were cut and individually placed on polystyrene trays and sealed after flushing with the gas mixture (70% O<sub>2</sub> + 20% CO<sub>2</sub> + 10% N<sub>2</sub>) in laminated pouches of polyethylene and polyamide.

**DISPLAY CONDITIONS:** packs were stored in a display cabinet simulating supermarket conditions. One section was illuminated by a standard supermarket fluorescent (Mazdaflour, Phillips Superaviva TF/36W). The second was illuminated by the same lamp with a Promolux UV Barrier & Multichrome Filter. The third was illuminated by a low-UV colour balanced Promolux lamp. The fourth section remained in darkness. All samples were exposed to light continuously (1000 lux) at the surface.

**COLOUR AND METMYOGLOBIN ANALYSIS:** The surface concentration (%) of MetMb was measured using a reflectance spectrophotometer (Minolta CM-2002) according to Stewart et al (1965). Zero % MetMb was determined by measuring the average value of the quotient between (K/S)<sub>572</sub> and (K/S)<sub>525</sub>, 100% MetMb was measured after oxidizing a sample in 1% (w/v) solution of potassium ferricyanide (Leward, 1970). Colour (CIE L\* a\* b\*) was also measured with the same spectrophotometer.

**LIPID OXIDATION:** Oxidative rancidity was measured using the reaction of malonaldehyde with thiobarbituric acid (TBA), as described by Witte et al. (1970).

**MICROBIAL ANALYSIS:** Total bacterial count was determined by swabbing an area of 10cm<sup>2</sup> (4''<sup>2</sup>) of the meat surface. Using conventional dilution procedures in 0.1% peptone water, aerobic psychrotrophic flora was grown in plate count agar (Merck; Darmstadt) and incubated at 10°C (50°F) for 7 days. Counts were expressed as colony forming units (cfu/cm<sup>2</sup>).

**SENSORY ANALYSIS:** Odor was examined, immediately and 20 min after opening of the bags, by three experienced evaluators and scored using the following scale: 1 =excellent (not different to fresh meat) 2= Good, but slightly poorer than fresh meat, 3 = Acceptable 4 = Hardly acceptable as fresh meat, 5 = Not acceptable