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Supplementation with turmeric residue increased survival of the Chinese soft-shelled turtle (*Pelodiscus sinensis*) under high ambient temperatures

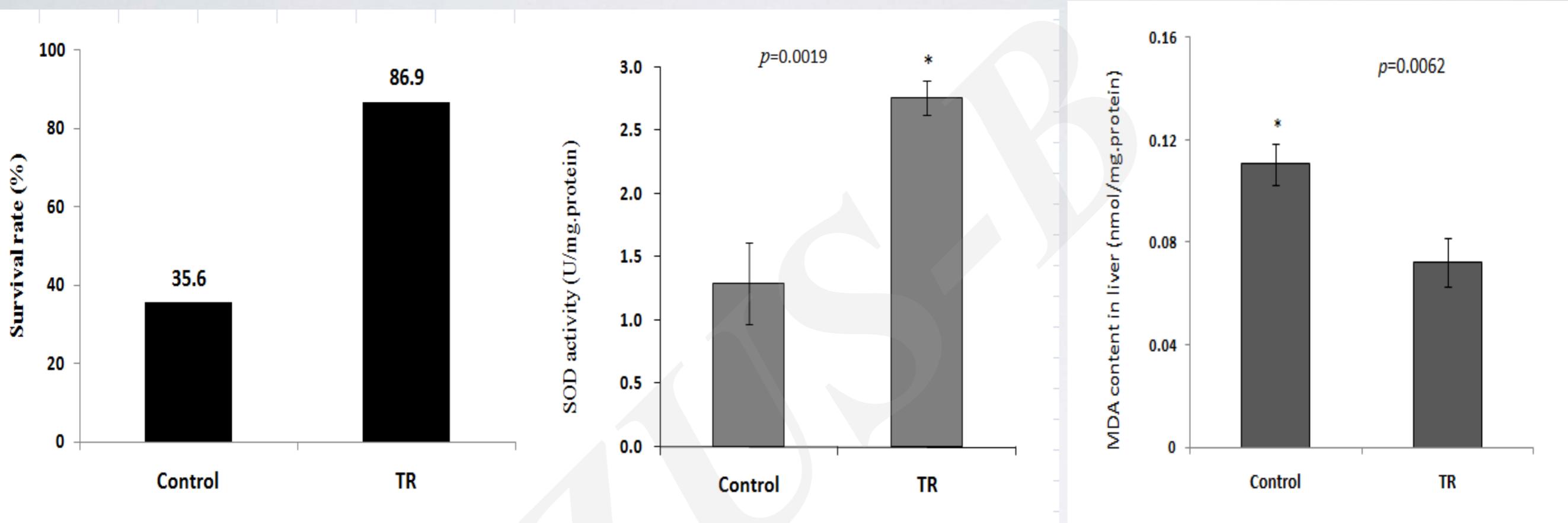
Key words: Turmeric residue (TR), Curcumin, Chinese soft-shelled turtle (SST), Survival, High ambient temperature, Antioxidant

Research Summary

Turmeric (*Curcuma longa* L.) root contains curcumin, a main bioactive polyphenol that possesses diverse biological functions such as anti-inflammation and diabetes. With the rapid development of the turmeric industry, there is a strong desire to find a way to make use of Turmeric residue. In this study, a feeding trial to evaluate the effects of TR on the survival of Chinese soft-shelled turtles (SST), *Pelodiscus sinensis* under a high ambient temperature was conducted.

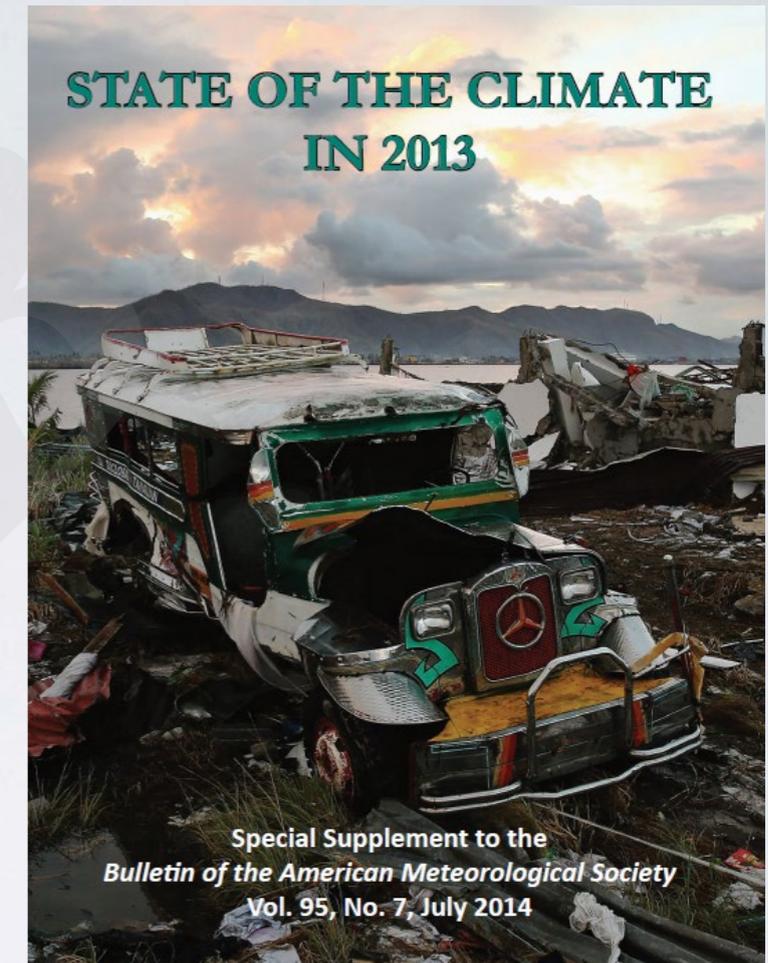
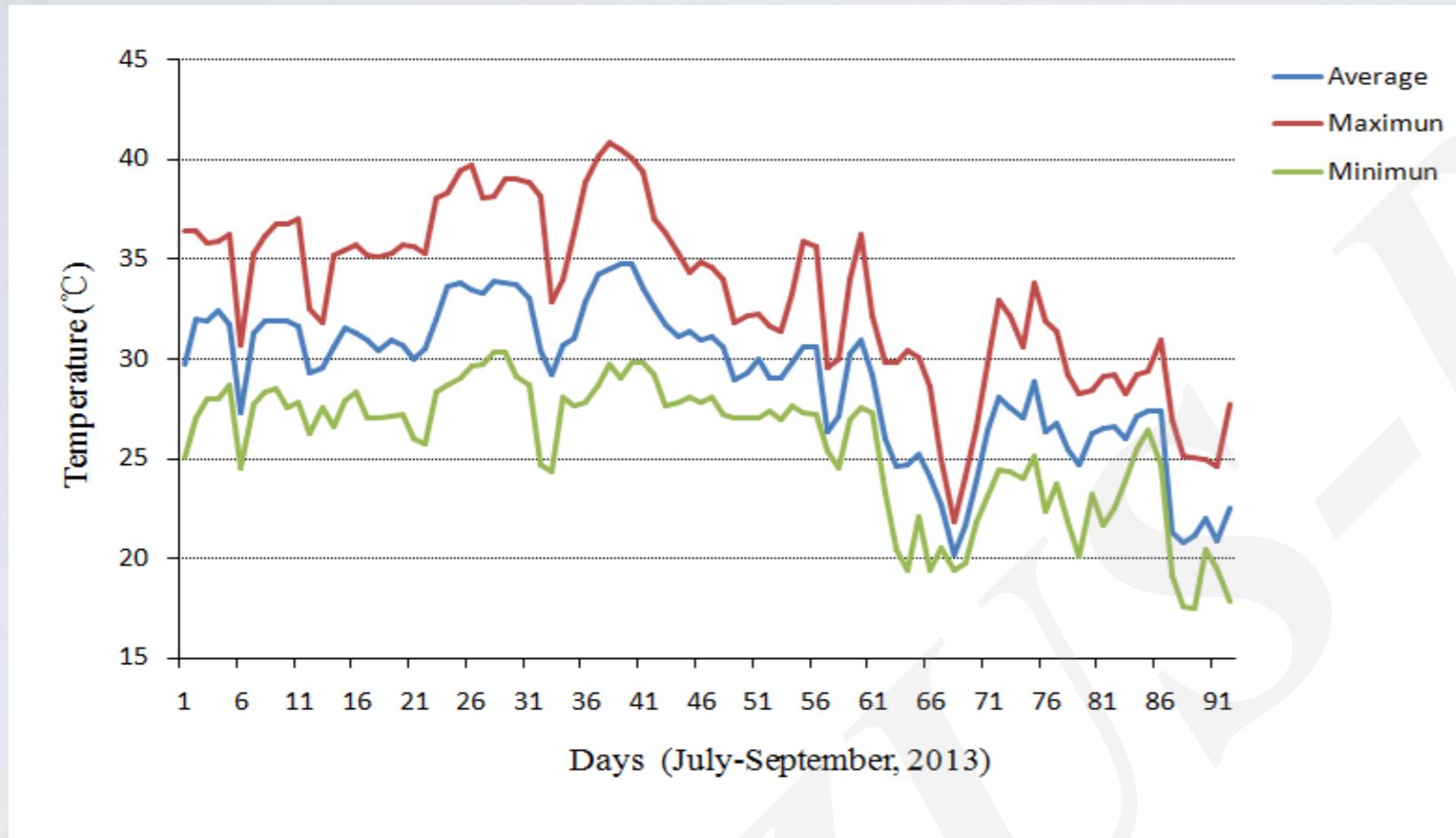


Innovation points



Our results demonstrated that supplementation of TR increased the SST survival rate by 51.3 points, superoxide dismutase activity (SOD) of SST liver by 112.8%, and decreased the malondialdehyde content (MDA) of SST liver by 36.4 %, compared to the turtles fed the basal diet.

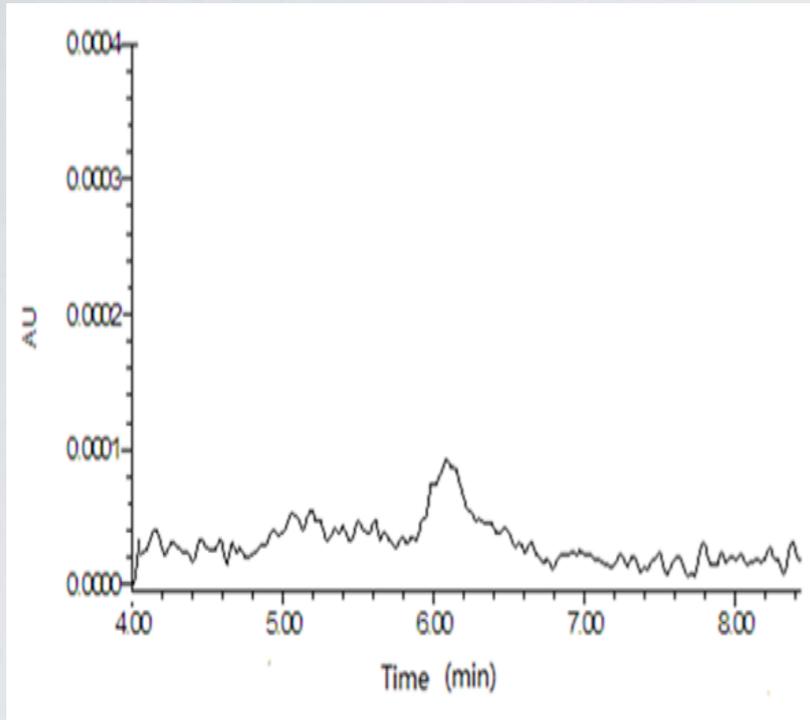
Innovation points



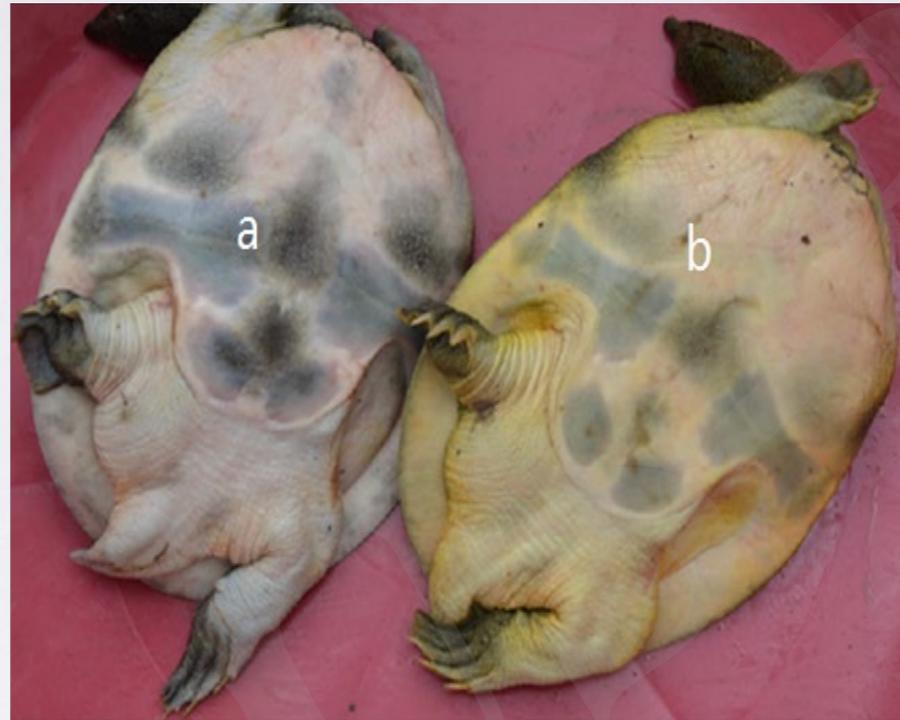
2013 was one of the 10 warmest years on record at the global scale. A persistent heat wave occurred from the beginning of July to the end of August across most of Southern China. We also found that the summer of 2013 in Haiyan had a successive 47 days of high temperature with maximum temperature $>35^{\circ}\text{C}$. In particular, a daily maximum temperature over 40°C persisted for five days during August. This could have resulted in a higher death rate of SST in the control group. It is estimated that supplementation of TR in SST diet resulted in reduction of oxidative stress and increasing survival rate of SST according to references.

Figure 4

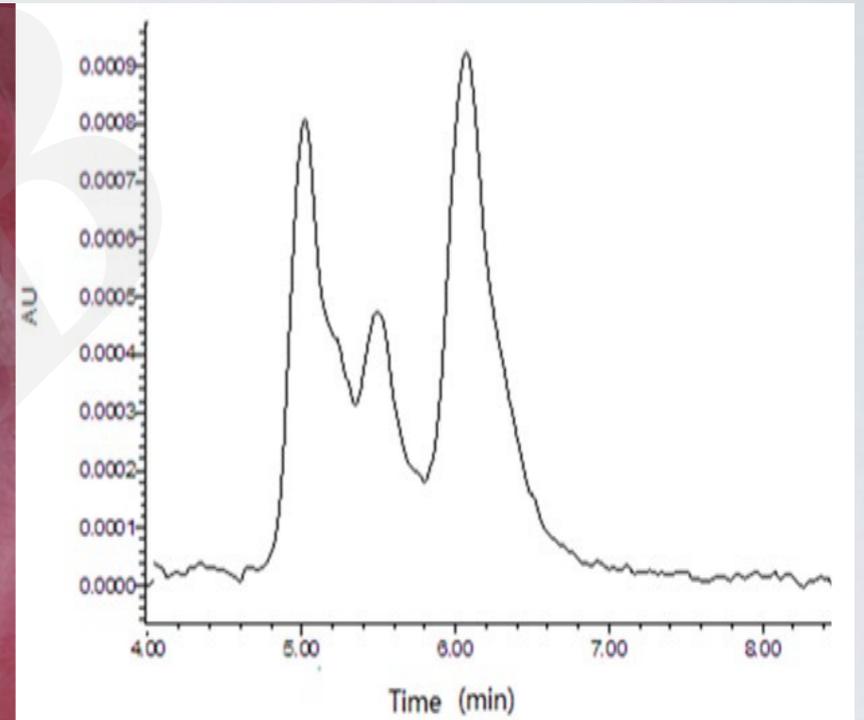
Innovation points



HPLC chromatograms of turtle skin from the control group (a)



a. Turtle fed base diet (control)
b. SST fed TR

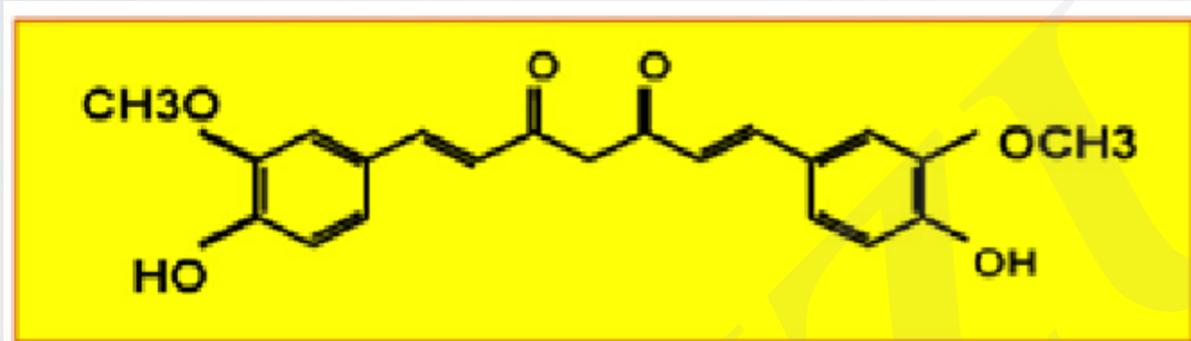


HPLC chromatograms of curcumin from the turtle skin of the TR group (b)

The skin of the turtle fed TR showed a golden color. High-performance liquid chromatography (HPLC) analysis indicated the skin of the turtle-fed TR contained curcumin $0.14 \pm 0.03 \mu\text{g/g}$, and no curcumin was detected in the skin of turtle fed the basal diet

Prospection

- Our findings that supplemental TR in SST feed increased survival rate via increasing SOD activity and decreasing the accumulation of MDA, will provide new knowledge to use TR as a feed additive in the animal industry and aquaculture.



- The deposit curcumin in the turtle skin showing golden color, a preferred color by consumers, provides a new route to increase the economic value of SST.



- Our findings could also have application to humans. Turtles in general have a high life expectancy for their size (~50 years in the case of the SST). Therefore, this animal could be used as a model of healthy aging in humans and it will be interesting to see if these findings apply to humans.