



The Effect of Different Diets on The Synthesis Ability and Gene Expression of Mandibular Gland in Honey Bee Workers

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Relationship Between Nutrition and Physiology of Bee



source →



Nutrition

Protein

Vitamins

Minerals

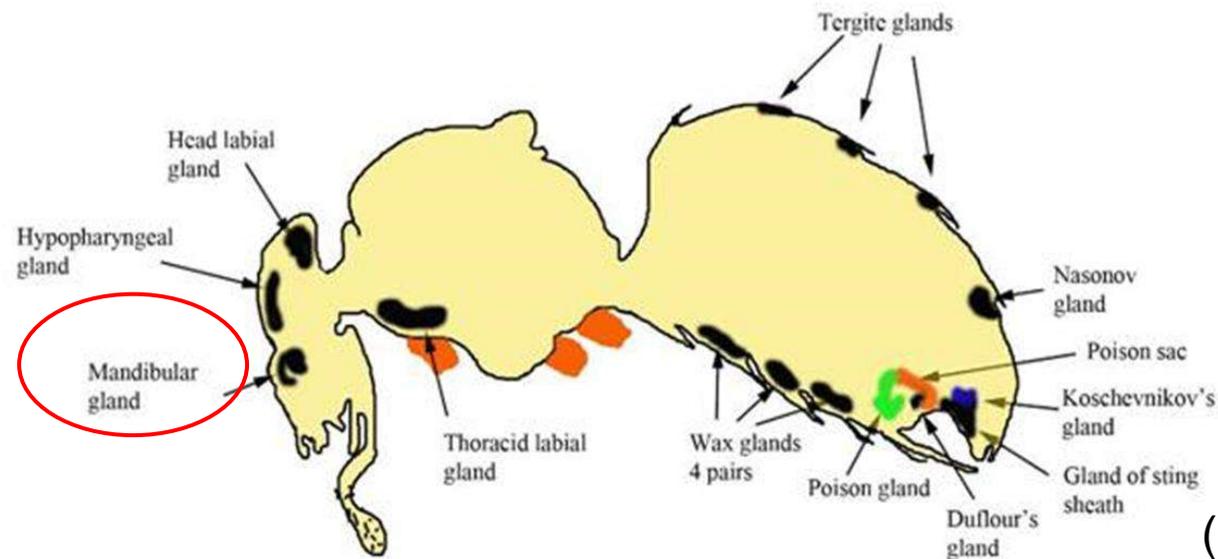
Royal Jelly (RJ)

- RJ is a secretion of the mandibular and hypopharyngeal glands of honey bee workers.
- RJ is the food of workers and drones within three days, but it is a sole food of the queen for her whole life.
- RJ has also been widely used in commercial medical products, healthy foods and cosmetics.



The Mandibular Glands (MG) of Honey Bee Workers

- Mandibular glands are a pair of large saclike exocrine glands on either side of the inner surface of the bee's head.
- Worker MGs mainly produce ω -hydroxylated decenoic acids, including 10-HDA and its precursor 10-HDAA, which account for 60–80% of the total fatty acid composition of royal jelly and influence larval growth.



The Research Process



Newly emerged
honey bee workers
(0–24 h old)

Pollen + Sugar candy

Soybean + candy

Sugar candy

0.5% Stearic acid
in sugar candy

0.5% Citric acid
in sugar candy



31.0°C, 75% (RH)

6, 9 and 12
days

10-HDA and
10-HDAA
Content analysis



Effect of Different Diets on 10-HDA and 10-HDAA Content

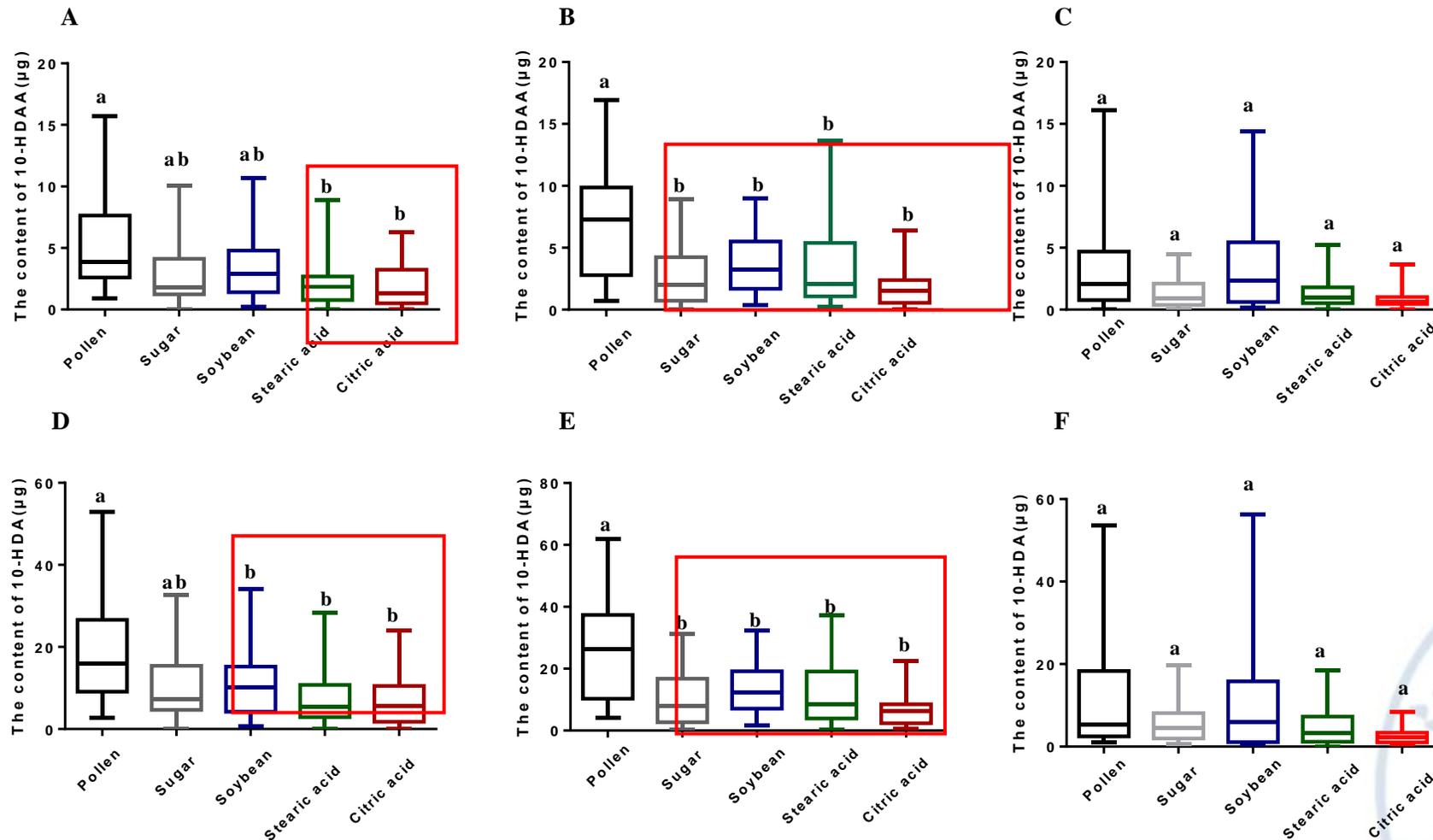


Figure 1. The content of 10-HDAA (A、B、C) and 10-HAD (D、E、F) in the head of workers fed by different diets. (A、D : 6 day old of worker ; B、E: 9 day old of worker ; C、F: 12 day old of worker)

The Ratio of 10-HDA and 10-HDAA

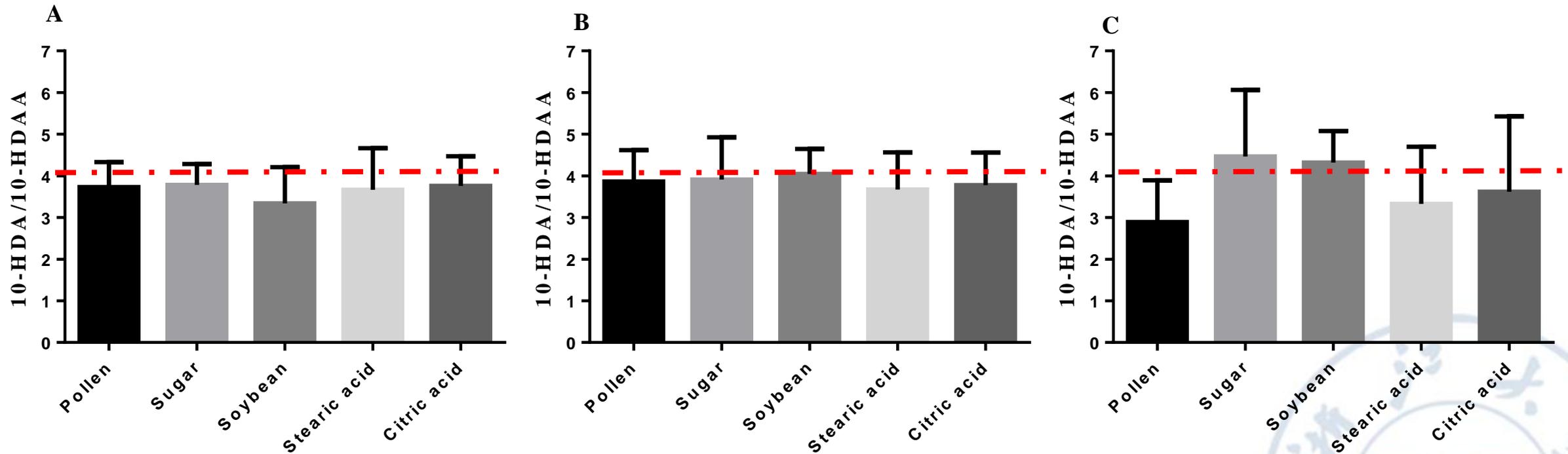


Figure 2. The ratio of 10-HDA and 10-HDAA (A: 6 day old of worker ; B: 9 day old of worker; C: 12 day old of worker ; Different Groups are not significantly different).

Effect of Different Diets on 10-HDA and 10-HDAA Content

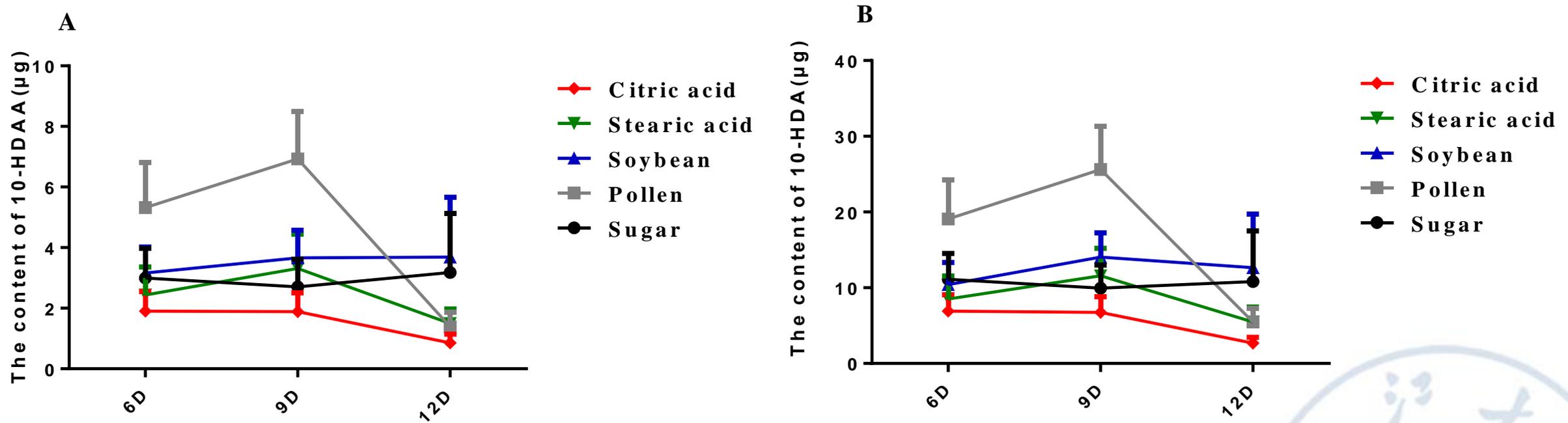


Figure 3. The content of 10-HDA and 10-HDAA in the head of workers fed with different diets.

Effect of Different Diets on Protein Concentration

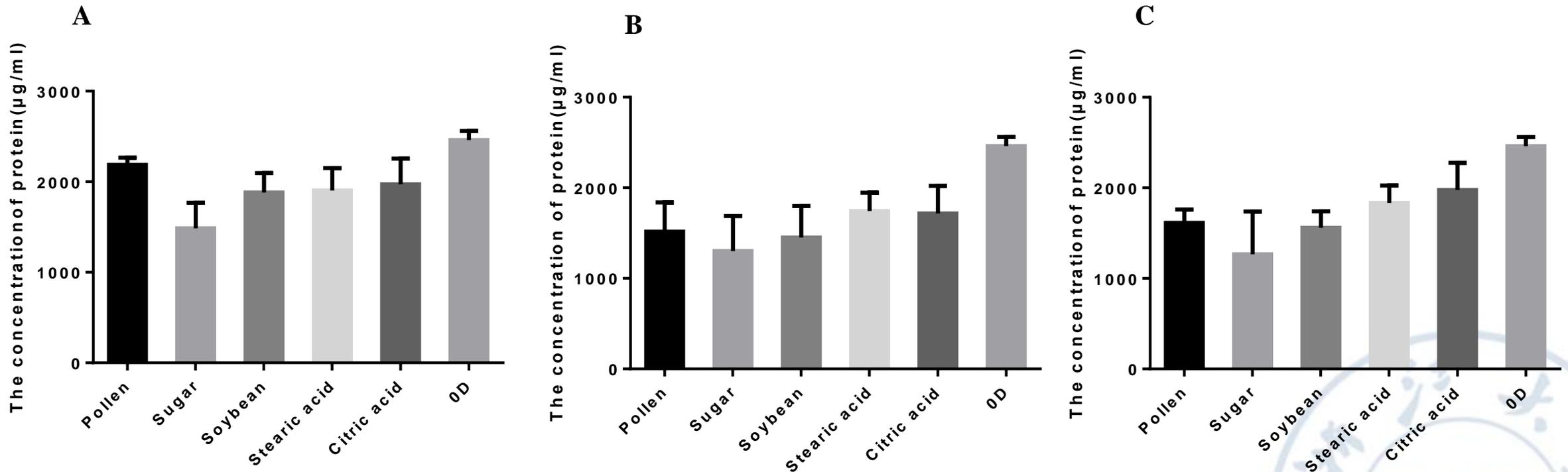


Figure 4. Average concentration of protein in the head mandibular gland of worker honey bees of different ages fed pollen (Control), soybean ,fatty acids, or a diet of water and syrup. (A:6 day old of worker; B: 9 day old of worker; C: 12 day old of worker)

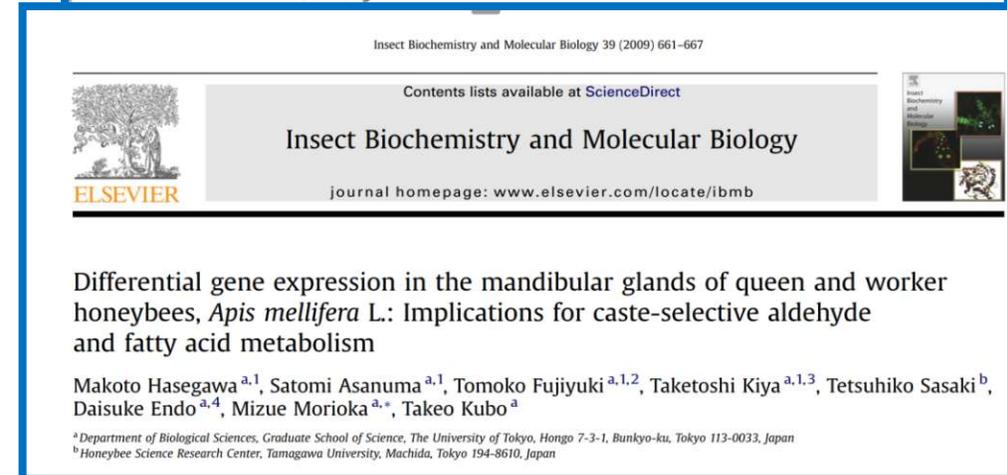
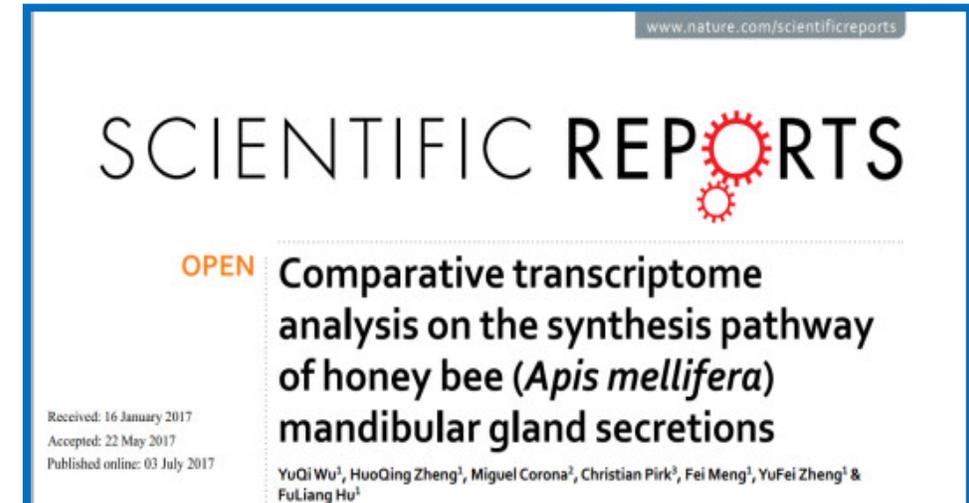
The Research Process

The same feeding method above

6, 9 and 12 days old

Dissected mandibular gland

RNA extraction



(Wu. *et al.*, 2017 and Hasegawa. *et al.*, 2009)

Effect of Different Diets on the Expression of *CYP6AS8* in the Mandibular Glands

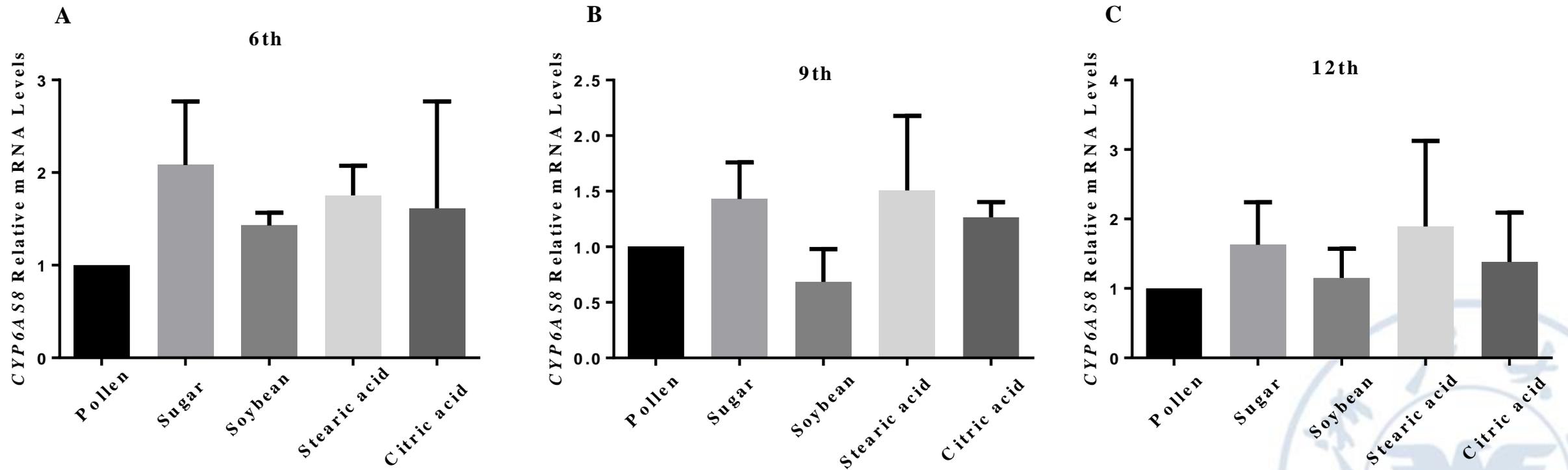


Figure 5. Detection of gene expressions of *CYP6AS8* (A:6 day old of worker; B: 9 day old of worker; C: 12 day old of worker ;*=P<0.05, **=P<0.01,***=P<0.001)

Effect of Different Diets on the Expression of *ACOX1* in the Mandibular Glands

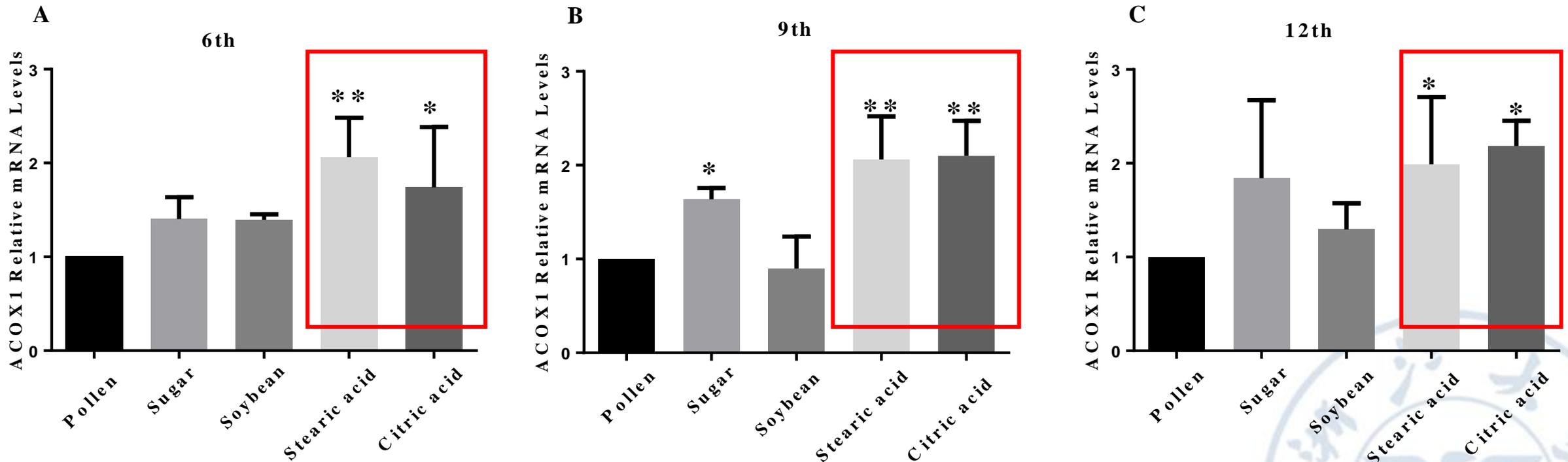


Figure 6. Detection of gene expressions of *ACOX1* (A: 6 day old of worker; B: 9 day old of worker; C: 12 day old of worker; * = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$)

Effect of Different Diets on the Expression of *CPT1* in the Mandibular Glands

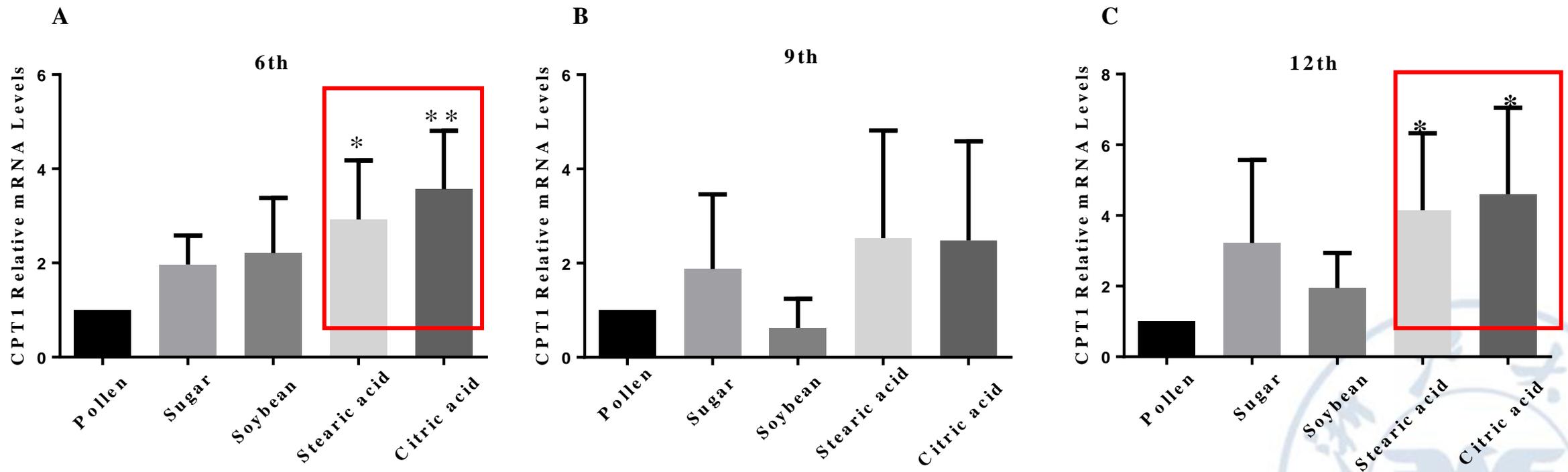


Figure 6. Detection of gene expressions of *CPT1* (A: 6 day old of worker; B: 9 day old of worker; C: 12 day old of worker; * = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$)

Effect of Different Diets on the Expression of ACOX3 in the Mandibular Glands

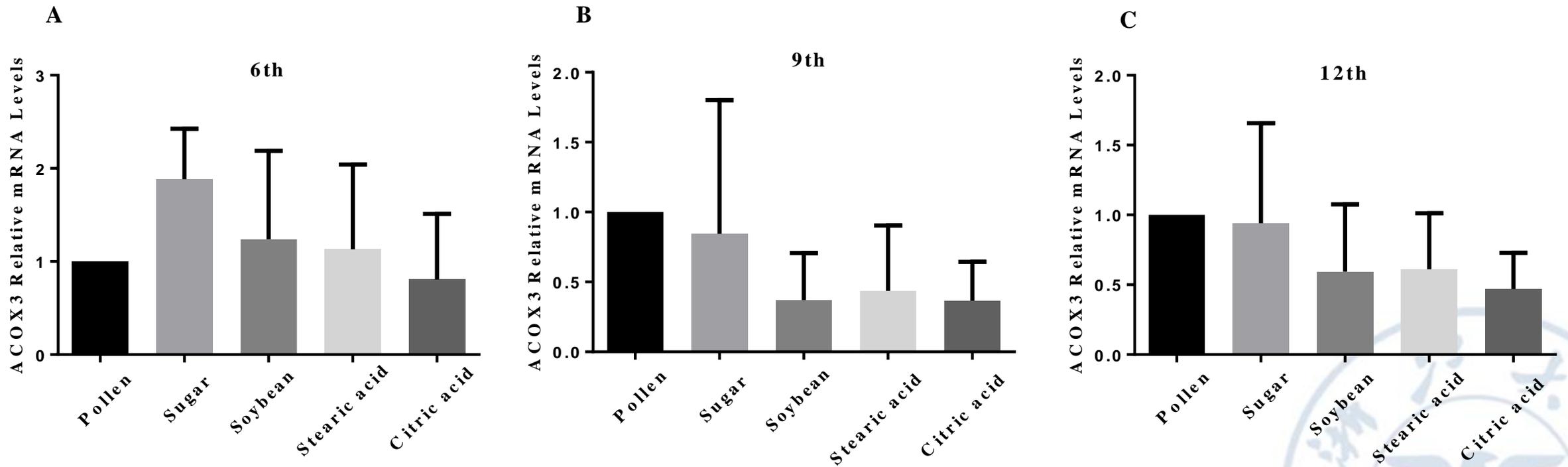
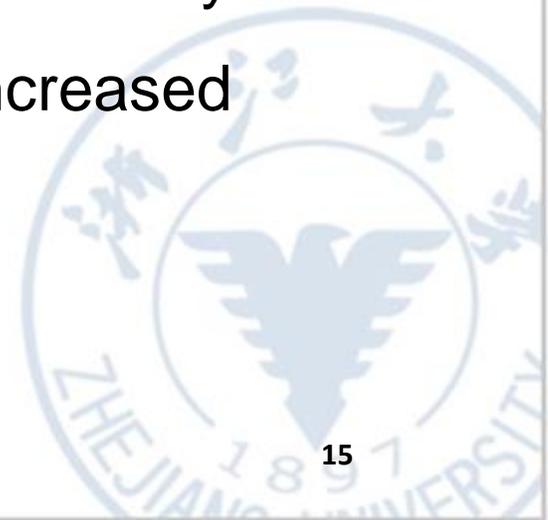


Figure 7. Detection of gene expressions of ACOX3 (A:6 day old of worker; B: 9 day old of worker; C: 12 day old of worker ; *= $P < 0.05$, **= $P < 0.01$, ***= $P < 0.001$)

Conclusion

- Nutritional deficiency reduced fatty acids contents, but did not affect composition of fatty acids.
- Nutritional deficiency did not affect the protein concentration of mandibular glands.
- Nutritional deficiency did not affect expression of genes in fatty acid synthesis pathway, artificially added fatty acids increased the expression of fatty acid β -oxidation genes.





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Thanks

