Digestibility of animal-based and plant-based diets in the tropical sea cucumber, *Holothuria scabra*

Since population of many sea cucumber species has been dwindling due to intensive fishery and trading in Southeast Asian countries, there is a need to artificially produce sea cucumbers by hatchery production and aquaculture. *Holothuria scabra*, commonly known as sandfish, has been most actively produced amongst tropical sea cucumbers, but the production efficacy remains low partly owing to the lack of information on its diet. *H. scabra* is a benthic deposit feeder, and it ingests a mixture of organic matters with sea sediment for feeding. It is hence difficult to determine what important nutrient sources in the sediment actually are. This study aimed to elucidate relative importance of animal- and plan-based diets for juvenile *H. scabra* by analyzing digestibility of different feed ingredients.

Apparent digestibility coefficient (ADC) of shrimp meal, mussel meal (animal-based), diatom and powdered seaweed (plant-based) was determined by tank rearing experiments. Compared to the plant-based diets, animal-based diets contained a higher fraction of organic matter and crude protein; on the other hand, the plant-based diets contained a higher fraction of crude carbohydrate. ADC of organic matter was significantly higher in the animal-based diets (77.1 – 86.2%) than in plant-based diets (32.3 – 55.1%). ADC of protein ($ADC_{protein}$) was significantly higher in shrimp meal, mussel meal and diatom (75.2 – 88.7%) than in seaweed (34.4%), indicating that animal diets are more reliable source of digestible proteins. ADC of carbohydrate (ADC_{carbo}) was generally lower than $ADC_{protein}$, and diatom and mussel meal (58.3 – 58.5%) had significantly higher ADC_{carbo} than shrimp meal and seaweed (28.0 – 31.6%) (Fig. 1). The high ADC_{carbo} in mussel meal may be attributable to its high content of glycogen that is readily digestible by animals unlike hard-digestible cellulose contained in a large amount in seaweed. Total assimilated nutrient (TAN) was estimated as the product of daily diet ingestion rate (IR) and ADC. The mean body weight of the experimental *H. scabra* was 10 g. TAN was largely affected by ADC since IR did not vary significantly amongst the diets. Shrimp meal had the highest TAN for organic matter (390 mg/day) and protein (347 mg/day) amongst the four diets, and diatom had the highest TAN for carbohydrate (247 mg/day) (Fig. 2).

H. scabra hatcheries commonly use diatoms and seaweeds as feed. This study indicates that there is a possibility that effective artificial feeds can be formulated by adding animal proteins to diatoms. High digestibility of animal-based diets also indicates that *H. scabra* is a good candidate for use in polyculture with finfish where feeds with high fish meal content are used.

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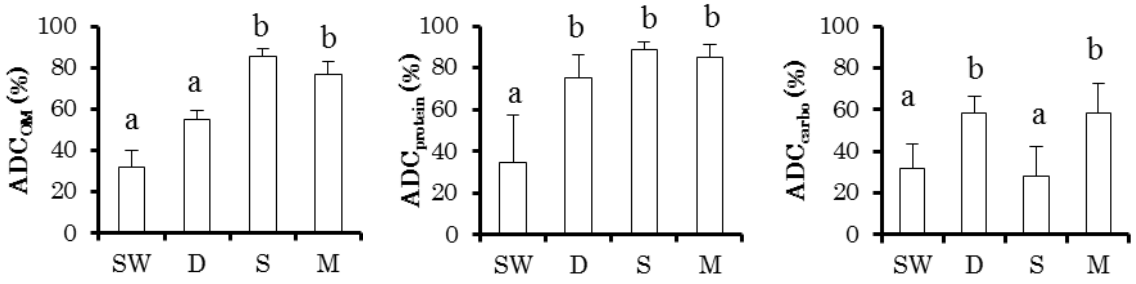

Fig. 1. Apparent digestibility coefficient of organic matter (ADC_{OM}), crude protein ($ADC_{protein}$) and crude carbohydrate (ADC_{carbo}) of seaweed (SW), diatom (D), shrimp meal (S) and mussel meal (M) in juvenile *Holothuria scabra*. ADC was obtained from the difference in nutrient contents between diet and feces. Different letters (i.e. a and b) indicate statistically significant difference ($p<0.05$).

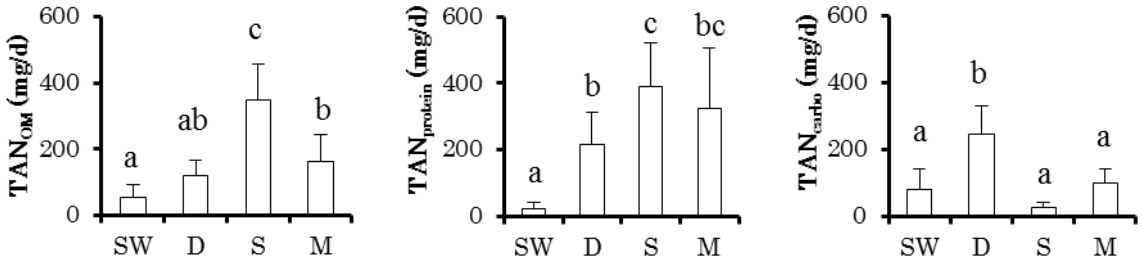

Fig. 2. Daily total assimilated nutrients (TAN) in juvenile *H. scabra* as obtained as the product of ADC and daily feed ingestion rate; assimilated organic matter (TAN_{OM}), crude protein ($TAN_{protein}$) and crude carbohydrate (TAN_{carbo}). The mean body weight of *H. scabra* was 10 g. Different letters (i.e. a, b and c) indicate statistically significant difference ($p<0.05$)