Nutritional and Biochemical Evaluation of Radiation Processed Marine Algae for Japanese Quail Diets

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THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree

Of
MASTER OF SCIENCE

In
AGRICULTURAL SCIENCES
(Animal Production – Poultry Nutrition)

Department of Animal Production
Faculty of Agriculture Al-Azhar University
Cairo-Egypt

1435 A. H.
2013 A. D.

APPROVAL SHEET

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INTRODUCTION

Algae are used by humans in many ways. They are used as fertilizers and are source of livestock feed or feed additives Seaweeds as macroalgae are an important source of food They are excellent sources as contained minerals. Moreover , quantities of harvested seaweeds used in cosmetics, pharmaceuticals and colloidal industries.

The seaweed aquaculture production (92% of the world seaweed supply) doubled between 1996 and 2004 and is estimated at 11.3 million wet tones, with 99.7% of the biomass being cultivated in Asia. Brown seaweeds represent 63.8%of the production, while red seaweeds represent 36.0% and the green seaweeds 0.2%. The seaweed aquaculture production is valued at 5.7 US$ billion (again with 99.7% of the value being provided by Asian countries) **(FAO. 2006).** Total annual value of production is estimated at almost 6 US$ billion of which food products for human consumption represent 5 US$ billion. Total animal use by the global seaweed industry is about 8 million tones of wet seaweed (**FAO , 2003)**. Today, approximately one million tones of wet seaweed are harvested and extracted to produce about 55.000 tones of hydrocolloids, valued at almost 600 US$ million **(McHugh, 2003).** Estimation world aquaculture production of seaweed supply was about 16 million wet tones during 2008. Total annual value of production is estimated at almost 7.4 US$ billion. **(FAO.2010)**

To date and world and worldwide more than 17.4 million tons of seaweed are commercially produced 6% collected from wild stock, 94% farmed. The seven top seaweed farming countries deliver 99.95% of the global farmed volume and are all situated within Asia. Most productive is most productive is China with 54% followed by Indonesia with 20% and the Philippines with 12% Chile is the most important seaweed farming country outside Asia having produced 88,147 tons in 2009, which is more than 99.9% of America's (north and south) total volume.

Certain edible seaweeds contain significant quantities of lipids, protein, vitamins and minerals **(Narziah & Ching, 2000, Sanchez-Machado et al, Wong & Chenng 2000**) although nutrient contents very with species, geographical location, season and temperature **(Dawes et al 1993 , Kaehler & Kennish, 1996)**. Also, Seaweeds can be used as a source of essential fatty acids such as eicosapentaenoic acid C20:2O3 **(Khotim-Chenko et al., 2002)** ; Omega 3 fatty acids such as C20:2O3 are thought to reduce the risk of heart diseases, thrombodis and are thought to reduce the risk of heart diseases, thrombosis and are atherosclerosis **(Mishra et al , 1993)** . It has also, been reported that fatty acids of certain seaweeds have antiviral activity **(Kamat et. al., 1992).**

There is therefore, interest in the use of edible seaweeds in the development of low- cost , highly nutritive diets for human and animal nutrition, especially animal nutrition since see vegetables are able to accelerate the growth of some species such as big, oystrs, tilapia, salmon, trout, ete., all off great commercial interest (**Fleming et al., 1996 and Hahn, 1989)**

Three *Ulva* species are reported to be of high productivity on the Egyptian coasts of the Mediterranean sea. *Ulva lactuca* is the most frequent in the intertidal zone. The other two are *U faciata* and *U. rigida*, (**Aleem, 1993**). In the Red Sea *U. reticulate*, *U. lactuca* and *U. faciata* are widely distributed in the different hibitates, **Farghaly, 1980.**

Ulva sp. as lite as most green algae are the lowest suitable or useful for non-nutritional industries, whereas, the have on important uses is humans, animals and poultry nutrition.

One of difficulty problems for using row algae and seaweeds in nutrition is low its digestibility because wall cell of algae is a type of complex polysaccharide are not digested by enzymes occurring vertebrate animals gut .

Several investigation were carried out to improve algal digestibility by different treatments such as : **El- Khimsawy, 1978** using freezing and blending ; **El-Khimsawy , 1983** using dram dried dehydration , **El-Khimsawy e al., 2006** using boiling or treated by HCl , NaOH solution or enzymes; **El-Khimsawy, 2009** using boiling with acetic acid and **El-Khimsawy, et al, 2010** using powdering and crushing. All these treatments significantly improved organic matter and all nutrients digestibility for algae, but it have high costs compared to control.

The objective of present study were aims to treatment of marine green macroalge (*Ulva* sp) by irradiation in order to broken down cell wall of algae and improve its digestibility with the lowest costs, consequently our study was investigated the effect of irradiation on chemical composition of algae and its protein quality. Also, present work aims to study the effects of addition of Ulva meal (raw and irradiated) in Japanese quail diets on growth Performance, Carcass quality and same biochemical measurements .

2- REVIEW OF LITERATURE

2-1: NUTRITIVE VALUE OF *ULVA* MEAL

2-1-1: Ulva as algae:

Marine algae or seaweeds, are the oldest members of the plant kingdom, extending back many hundreds millions of years. Algae live in a wide range of aquatic environments and are a natural component of most equate ecosystems . They are a vital part of the aquatic environments and are a natural component of most aquatic ecosystems. They play a crucial role in the ability of on aquatic ecosystem to absorb nutrients and heavy metals. They have little tissue differentiation, no true vascular tissue, no roots, stems or leaves and no flowers. Algae range in size from microscopic individual cells to high plants more than 100 feet long **(Madge and Joanne ,1987).**

The green algae chlorophyta are probably the most structurally diverse group of algae with many types , **Mattox and Stewart, 1984**, Most of the marine green algae belong to the Ulva phyceae, a generally tropical and subtropical group containing number of relatively large forms (e.g. Ulva, codium, valonia …eet., (**Graham, 1984).**

Ulva generally lives in the middle to low inter-tidal zone and sublittaral zone. The fronds are not stinted at the same level throughout the year. In the colder months, the algae grow mainly in wide bands in the inter-tidal. In the warmer months, they grow in a narrower band, lower in the inter-tidal, **El- Zaabdawy , 2006.**

Minimizing the amount of time they spend out of the water, under the hot summer sun, protects them from desiccation. Ulva are greatly impaired by extreme desiccation (defined as loss of more than 25% original water content), **(Shin and Simith, 1995**). **Aleem, 1993** stated that the most common *Ulva* species in Mediterranean sea are : U. lactuca, L.; U. fasciata, Dehle; U. linza, L.; U reticlata, farsskul and U rigida, C. Agurdh.

All green algae have mitochondria with flat cristae the storage product for members of this group is true starch, amylose, and amylopectin [α- 1.4-linked polyglucans], and is found inside the chloroplasts. The starch [seen as whitish granules with the TEM can often be observed surrounding the pyrenoid, a distinct spherical structure embedded in the chloroplast. There may be more than one pyrenoid or the pyrenoid is not always present or the pyrenoid is lacking. In most representative taxa, the cells are surrounded by a cellulose cell well (**Wehr and Sheath, 2003**). Some taxe may also have chitin or sporopollenin deposited on the wall. This gives added strength and is thought to help prevent desiccation. Some taxa have wall ornamentation, such as scales, a rough teture, thick walls with distinct layers, warts, ridges, and spies. The volvocales usually have cell walls, loricae, or gelatinous matrices and the main component of the cell walls is glycoprotein, rather than cellulose.

Sea lettuce:

The sea lettuces comprise the genus Ulva, a group of edible green algae that is widely distributed along the costs of the world's oceans. The type species within the genus *Ulva* is *Ulva lactuca*, lactuca being latin for " lettuce" the genus also includes the species previously classified under the genus Enteromorpha, **(Hillry et al, 2003)** the former members of which are known under the common name green nori **(Guiry and Guiry, 2012).**

Sea lettuce is eaten by a number of different sea animals, including manatees and the sea slugs known as sea hares many species of sea lettuce as a food source for humans in Scandinavia, Great Britain, Ireland, China and Japan (where this food is known as aosa).

Individual blades of Ulva can grow to be more than 400mm (in size), but this only occurs when the plants are growing in sheltered areas.

In August 2009, unprecedented amounts of these algae washed up on the beaches of Brittany, France, causing a major public health scare as it decomposed. The rotting leaves produced large quantities of hydrogen sulphide, a toxic gas. In on incident near saint-Michel-en Greve, a horse rider lost consciousness and his horse died after breathing the seaweed fumes; in another, a lorry driver driving a load of decomposing sea lettuce passed out , crashed and dried , with toxic fumes clamed to be the cause (**BBC, 2009**). Environmentalists blamed the phenomenon on excessive use of nitrates by big and poultry farmers.

It is a thin flat green alga growing from a discoid hold fast Fig (1-3). The margin is somewhat ruffed and often torn. It way be reach 18 cm or more in length, though generally much less , and up to 30 cm across. The membrane is two cells thick , soft and translucent, and grows attached, without a stripe to rock by a small disc-shoped holdfast. The color of Ulva was green to dark green.

Ulva lactuca is a species belong to genus .*Ulva*; Family: Ulvaceae; Order Ulvales, class Ulvophyceae, Phylum chlorophyta, Kingdon plantae, Domain Enkaryota (**Guiry and Guiry, 2008**).

El-Khimsawy, 1978 reported that *Ulva* sp amounts as dry matter which collected from Egyptian coasts of Mediterranean sea were about 42.5% from all seaweeds mixture.

Sea lettuce production may be performed as aquaculture system. In Israel sea lettuce was produced by this system as 20 gm. fresh weight of algae per m^2 per day **(Neori et al., 1996)**

2-1-2: Ulva as feed and food

Sea lettuce as a food for humans is eaten raw in salads and cooked in soups. It is high in protein, soluble dietary fiber, and a variety of vitamins and minerals, especially iron.

Seaweeds had been used for many years directly for human consumption and animal feed . It is also an ingredient for the global and cosmetics industries and is