POLYUNSATURATED FATTY ACIDS PRODUCTION FROM ALGAE AND THEIR APPLICATION IN THERAPEUTIC NUTRITION

By

SHERAZ MOSTAFA KAMAL ELSAYED ABD-ALLAH

B.Sc. Agric. Sc. (Food Sci. & Tech.), Ain-Shams University, 2009

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ABSTRACT

Sheraz Mostafa Kamal ELSayed Abd-Allah: Polyunsaturated Fatty Acids Production from Algae and Their Application in Therapeutic Nutrition. Unpublished M. Sc. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2017.

Firstly, two different microalgae were used in the current study to evaluate whether their successive indoor growth using industrial food wastes including okara and potato peels as growth enriching medium.

The used algae were *Chlorella vulgaris* and *N*annochloropsis *oculata*. The basic nutrient solutions were BG-II for *Chlorella*, while F2 was used for *Nannochloropsis* growth. Okara as well as potato peals extracts were used in four concentration (25, 50, 75, 100 %) verses to control and based on their initial nitrogen content. In both in and out-door cultivation, the investigated parameters were dry weigh ($g.l^{-1}$); total chlorophyll ($mg.l^{-1}$) and total carotenoids ($mg.l^{-1}$). Maximum dry weight of *Chlorella* was obtained with 25% of okara waste extract. As for *Nannochloropsis*, a slight increase was observed with all okara extract concentrations used. Data of dry weight for *Chlorella vulgaris* showed that the lowest concentration (25%) of potato peels extract surpasses all other tested concentrations . While in the case of *Nannochloropsis oculata* increasing of potato peels extract percent led to the marked increase of dry weight accumulation. Induction of algae was done with cultures those resulted in maximum dry weight with the proper waste extract concentration in presence of stress factors. Sodium chloride (1 and 2 %) with 125 ppm ferrous sulfate was used as stress factors engaged the accumulation of algal lipid in the presence of organic carbon from wastes.

Okara and potato peels extracts in stressed growth media supporting algae by an extra potential in concern carotene accumulation. Sodium chloride at 1.0 and 2.0% increased carotene content as fed by zero time.*Chlorella vulgaris* was found to be rich in protein (48.2%)

rather than *Nannochloropsis oculata* (28.0%). On the other hand, oil content of *Nannochloropsis oculata*(12.4%) surpasses *Chlorella vulgaris* content (9.51 %).

Once growth conditions in concern nutritional status were changed by stress conditions, such chemical composition was dramatically changed. Thus, oil content of both algae was raised to be 14.9 and 16.57% with *Chlorella vulgaris* and *Nannochloropsis oculata*, respectively. The effect of microalgae *Chlorella vul*garis and *Nannochloropsis oculata* as a food supplement on body and organ weight, lipid profile, liver and kidney functions and histopathological examination of liver, kidney and spleen tissues in hyperchlosterolmic rats was evaluated.

the present study suggests that algal treatment with *Chlorella* and *Nannochloropsis* elicited anti-hypercholesterolemic properties by significantly lowering the level of lipids by reducing serum total cholesterol, serum triglyceride and LDL-c levels. *Chlorella* and *Nannochloropsis* significantly increased also the HDL-c and corrected liver and kidney functions, especially alanine aminotransferase (ALT), aspartate aminotransferase (AST), urea and creatinine, reduced atherogenic index (AI) and increased HTR (%) as compared to untreated hypercholesterolemic ones. The histopathological examination of liver, kidney and spleen of hypercholesterolemic-treated rats with algae indicated that the *Chlorella vulgaris* and *Nannochloropsis oculata* biomass are potent natural hypocholesterolemic supplementations or nutraceuticals for the amelioration of hypercholesterolemia in rats.

In this study , we intended to produce cookies by utilizing fresh and dried *Chlorella vulgaris* algae at concentration level of 1, 2 and 3 % with 0 % serving as control. Protein and fat content for both samples of cookies with fresh and dried *Chlorella vulgaris* algae increased by increasing the level of addition compared with control samples. Spread

ratio of cookies with dried and fresh *Chlorella vulgaris* algae increased by increasing the addition level.

The lightness (L-value) was slightly affected by addition of dry algae .The yellowness (b-value) of the cookies sample ranged between 29.5 to 35.69).The remarkable differences in the rheological parameters of the tested cookies samples was that of the work (Energy) required to break the samples. The cookies with fresh *Chlorella vulgaris* has high scores of sensory evaluation compared with the control. These results revealed that cookies are traditional and nutritious food , can be healthy and very attractive when prepared with the addition of fresh *Chlorella vulgaris* . Moreover, the enhancement of textural properties and the good nutritional profile of the cookies obtained , reveal a new niche food market .

Key words : Algae, *Chlorella vlgaris*; *Nannochloropsis oculata*; poly unsaturated fatty acids; omega – 3; okara; potato peels waste; stress conditions; hypercholesterolemic and cookies.

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