



**STUDIES ON EXTRACTION OF SOME FUNCTIONAL  
SUBSTANCES FROM THE GREEN ALGA *CHLORELLA*  
*VULGARIS* AND THEIR APPLICATIONS IN SOME FOOD  
PRODUCTS**

BY

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B.Sc. Agri. Sci., Food Science and Technology, Faculty of Agriculture., Fayoum  
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M. Sc. Agric. Sci., Food Science and Technology, Faculty of Agriculture.,  
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## ABSTRACT

### **Studies on extraction of some functional substances from the green alga *Chlorella vulgaris* and their applications in some food products**

In this study, *Chlorella vulgaris* was grown in the laboratory to obtain benefit from chlorella powder. The chemical composition of *Chlorella vulgaris* was estimated and the active ingredients were extracted using solvents (water, ethanol 50% and ethanol 95%), and the total content of phenols and flavonoids was estimated, and it was (183.5 mg gallic acid/g - 54 mg quercetin/g, 145.5 mg gallic acid /g – 51.3 mg quercetin /g, 127.7 mg gallic acid/g - 37.4 mg quercetin /g) for both aqueous and ethanolic extracts 50% and 95%, respectively. Then study the effect of these extracts on (*B. subtilis*, *E. coli* and *Staph. aureus*) all extracts had an effect on the types of bacteria tested, except for the aqueous extract, which had no effect on *E. coli* bacteria. As for the antioxidant activity, it was measured using the DPPH and Total antioxidant capacity (TAC) test, where it was noted that the aqueous extract was the best extract as an antioxidant. The study also aimed to fortify some food products with chlorella powder and its extracts, such as using chlorella powder in making beef burgers in concentrations (0.5%, 1% and 1.5%), and using chlorella powder as a substitute for wheat flour to make cakes in different percentages 0.5%, 1% and 2%. Finally, chlorella powder and 95% ethanolic extract were used as antioxidants for cake after adding them to the oil at concentrations (200ppm and 500ppm for both powder and extract), comparing them with 200ppm BHT. These products were stored and their chemical and microbial quality characteristics were estimated during storage. The sensory properties and chemical composition of the products were estimated. The oxidative stability of cake and soybean oil to which chlorella extract and powder were added was also studied on a Rancimat device.

The results were as follows: For the burger treatments, at the end of the storage period, it was observed that the microbial load of the samples containing chlorella powder decreased compared to the control, and there

was high stability in the TVN values for the treatments compared to the control. A similar effect was also observed for both concentrations of 1% and 1.5%. pH values were higher for all treatments, with a lower total Acidity for all treatments compared to the control. It was noted from the results of the sensory evaluation that the samples containing chlorella powder at a concentration of 0.5% were close to the control, but the rest of the concentrations were less sensory characteristics. Adding chlorella powder to the cake at concentrations of 0.5%, 1% and 2% increased both the protein, ash content and the specific volume of the cake, but these concentrations affected the color of the cake, reducing its sensory acceptability. As for the results of cake containing Chlorella powder and ethanolic extract at concentrations of 200ppm and 500ppm, and BHT at a concentration of 200ppm. It was noted that all treatments were higher than the control in terms of the total content of phenols as well as antioxidant activity. With storage, it was noted that all treatments were better than the control in terms of peroxide values, as well as TBA and p- anisidine. The samples containing 500ppm Chlorella powder and extract were better than those containing the synthetic antioxidant BHT 200ppm. These results are also consistent with those obtained with the Rancimat device. It was also observed from the estimation of the total bacterial count that the treatments with the highest microbial stability were the treatments containing 500ppm chlorella powder, followed by those containing 500ppm ethanolic extract. Soybean oil containing BHT at a concentration of 200ppm was the most stable, followed by oil containing chlorella powder 500ppm, followed by ethanol extract 500ppm, then chlorella powder and extract 200ppm. All of them were more stable than the control. It is clear from these results that the addition of chlorella powder and ethanolic extract plays a role in reducing the number of microbes, as well as that they contain natural antioxidants that prolong the shelf life of cakes and burgers and preserve and increase the nutritional value.

**Key words:** *Chlorella vulgaris*, Beef burger, Antioxidant, Rancimate, Antimicrobial, Cake, Natural additives, Soya oil.