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Screening of Fresh water and Sea water Microalgae strains from Qatar for feed supplement production

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The worldwide continuous increasing of population provokes an increasing awareness about the food security. Qatar is one of the first countries establishing a Food Security Strategy Program to satisfy the demand of food and feed. Microalgae is considered as one of the most promising solution based on its ability to produce the essential elements needed for food and feed such as lipids, carbohydrates, proteins... In Qatar University, a diverse collection of Microalgae and Cyanobacteria strains isolated from different environments was established (QUCCCM). Microalgae, These photosynthetic microorganisms are capable of converting solar energy into useful compounds. Microalgae accumulate several kinds of metabolites such as proteins (6-52%), lipids (7-23%), carbohydrates (5-23%). In addition, microalgae produce have the ability to produce high-value metabolites. The aim of our work was to screen the QUCCCM and identify potential strains with high nutritional value for use as feed for poultry and livestock. In this study, Microalgal isolates belonging to 12 different species were investigated for their eligibility to be used as a feed. All strains were cultivated over a period of 10 to 15 days depending on species. Optical Density and Dry weights were recorded every three days to follow the algal Growth. The results showed the presence of three categories of isolates (fast, medium and slow growing). Among them, the species *Chlamydomonas* sp. presented the highest growth rate (μ) with $0.89 \text{ day}^{-1} \pm 0.27$ and a doubling time of 1.28/ day. Based on this result, the fast-growing strains were subjected to metabolite investigations in terms of lipids, proteins, carbohydrates, amino acids and Fatty acids to select the ideal strain(s) presenting high growth rate along

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with metabolites valuable for algae-based feed supplement. The highest protein and Lipid content was observed in the case of a freshwater strain belonging to the *Mychonastes* sp. with $\sim 50\%$ w/w and $40.7\% \pm 0.015$ respectively. Carbohydrates were seen highest in *Chlorococcum* sp. with a value of $30\% \pm 0.009\%$. Considering the marine strains, the isolates had a similar range of protein, Lipids and Carbohydrates content of (22%-34%), (32%-39%) and (8%-20%) respectively. Based on this study, one marine strain (*Pichochloris* sp.) having $33\% \pm 0.021$ content of protein and $32.7\% \pm 0.036$ as lipid, and one freshwater (*Mychonastes* sp.) holding the highest amount of metabolites were selected for deeply investigations in terms of FAME and Amino acid profiling which are crucial parameters that determine the feed quality. The results showed the presence of different essential Amino acids in the total protein fraction. Fatty acid profiling comprised saturated and unsaturated fats for all strains; most of them being rich with C18:0; C16:0 and C16:3. For the selected strains, the metabolite content during the growth period was followed by sampling every 3 days in order to identify the stage having high productivity and rich metabolite content. The analysis of the isolates showed an increase in the production of each metabolite during the growth, wherein lipids and protein amounts are relatively high while carbohydrates were comparatively low. These two selected strains will be improved in terms of lipid and protein production using media and salinity stress in order to enhance the production of essential nutrients such as omegas, amino acids and used for animal bioassay. In Conclusion, this study showed the existence of a diverse and rich collection of valuable strains with important metabolites that can support the country's food security program, by providing microalgae to supplement animal feed. Additionally, the potential candidates can be used for commercial applications. Keywords: Microalgae, animal feed, lipid, protein, essential amino acids