**Research Article** **AJAR (2020), 5:94**

**American Journal of Agricultural Research (ISSN:2475-2002)**

# *Prosopis cineraria* (Ghaf): An Unconventional Desert protein rich supplement

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## ABSTRACT

*Prosopis cineraria* (Ghaf) is not well known as a rich and sustainable source of protein for many people in the world. It emphasis on its broad food and non-food applications, nutritional values and health benefits. This research was carried out to meet the increasing demand of protein, alternative strategies and unconventional sources of protein for human and animal nutrition. This is probably the first research work which provides a comparative study between the protein content of ghaf leaves with different species of fish muscle protein. Fish muscle homogenate was prepared using ice cold distilled water. The muscle homogenate of *Euthynnus affinis* showed highest protein 137.5 mg/g. The other fishes muscle protein were *Carangoides chrysophrys* (43.33 mg/g), *Lenthrinus lentjan* (105 mg/g), *Sardinella longiceps* (104.17 mg/g), *Pomacanthus maculosus* (81.67 mg/g), *Nemipterus japonicus* (111.67 mg/g), *Lutjanus ehrenbergi* (99.17 mg/g), *Gerres oyena* (107.5 mg/g), *Argyrops spinifer* (100.83 mg/g), *Terrapin jarboe* (82.5 mg/g), *Tilapia mossambica* (54.72 mg/g). Ghaf tree is a keystone species having multiple beneficial uses from combating desertification and improving soil fertility in arid environments to being an essential food source, as well as a source of fuel, shelter and medicine for both humans and animal species. The Ghaf leaves extracts were tested for protein content analysis. The protein content in Ghaf leaves was found to be 88.61 mg/g. Thus, the research results revealed that Ghaf leaves has almost similar amount of protein as compared to fish muscle protein and can be used as protein supplement for growth and metabolism of body.

**Keywords**: *Prosopis cineraria*, Leguminosae, nutritional value, protein content, fish species.

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**How to cite this article:**
Saif Al Ghais, Vibha Bhardwaj, Pramod Kumbhar. *Prosopis cineraria* (Ghaf): An Unconventional Desert protein rich supplement. American Journal of Agricultural Research, 2020,5:94.

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## Introduction

*P. cineraria* is one of the most drought-tolerant tree species and thrives in hot, arid regions with an annual rainfall of less than 500 mm. In 2008, it was declared as the national tree of the UAE where it is known as Ghaf because of its great cultural and traditional significance. Trees of *Prosopis* genus, which belongs to the Leguminosae family, are one of the most important source of proteins in arid and semi-arid regions. The continuous world population growth, inadequate protein sources, exorbitant cost of animal protein is considered the main reasons for malnutrition and undernourishment among people living in many developing countries around the world.

Numerous people around the world, especially in Africa and Asia, are suffering from protein deficiency due to lack of protein-rich food. The protein content in *Acacia nilotica* is 25.47% and 38.89% in *Acacia senegal* (Balogun et al 1986)[1]. On other hand, legumes contain 18–35% protein (Jahreis et al 2016)[2], and cereals contain 10–15% protein (Breene et al 1931)[3]. Therefore, *P. cineraria* (Figure 1) can be considered a potential and cheap source of protein for industrial use, especially in developing countries and can be an alternate protein source for solving the protein-energy-malnutrition problem.

## Fish

Fish and marine invertebrates are an important part of our diet as they contribute to the intake of health-pro omega-3 fatty acids and possibly to prevention and treatment of coronary heart diseases. The crude protein contents of seafood's generally vary between 11.0% and 28.4% (usually about 19.0%), and the content of lipid in muscle tissue is inversely related to its moisture content (Venugopal et al, 1996)[4]. The contribution of non-protein nitrogenous compounds to the total crude protein content of seafood's depends on the species of raw material and range from 10% to 40%. Fish muscle is of two kinds, light muscle and dark muscle. The amount of protein in fish muscle is usually somewhere between 15 and 20 per cent, but values lower than 15% or as high as 28% are occasionally met with in some species. The composition of a particular species often appears to vary from one fishing ground to another, and from season to season, but the basic causes of change in composition are usually variation in the amount and quality of food that the fish eats and the amount of movement it makes. Fish protein provides a good combination of amino acids which is highly suited to man's nutritional requirements and compares favorably with that provided by meat, milk and eggs.

**Figure 1. The tree of *Prosopis cineraria* and leaves (Wikimedia.org and botanicimage.com)**

Despite fabulous importance of ghaf in desert culture, there is minimal aware by the developed communities about *P. cineraria* as protein supplement. In our previous study we investigated that ghaf is a potential desert nutraceutical and compared the nutrients of ghaf with spinach and lettuce (AlGhais et al 2020)[5]. Therefore, to continue our further research and

to meet the increasing demand of nutrition and protein, alternative strategies and unconventional sources of nutrition and protein for human and animal, we purposed this study to investigate. Hence, the objective of this study were to compare the protein content of ghaf leaves with different species of fish muscle protein. This research was carried out as an awareness of nutrition value of ghaf leaves as potential protein supplement.

## Material and methods

### Sample collection

### Ghaf Leaves

Samples of leaves (Three) of ghaf were collected in month of march from Dahan garden, Ras Al Khaimah, UAE. Samples were kept in sterile polythene bags till their use.

### Fish

Experimental fishes (F) (Three) in the present study were *Carangoides chrysophrys*, *Lenthrinus lentjan*, *Sardinella longiceps*, *Euthynnus affinis*, *Pomacanthus maculosus*, *Nemipterus japonicus*, *Lutjanus ehrenbergi*, *Gerres oyena*, *Argyrops spinifer*, *Terrapin jarboe*, *Tilapia mossambica*. They were taken from unpolluted fish market located in Ras Al Khaimah, UAE. The initial body length and weight of fish were (10-40 cm) and (115-640 g), respectively. All fishes were transported in plastic containers with continuous aeration to the lab. Fishes were dissected. Muscle were dissected out and used for analysis. Samples were obtained from all fishes.

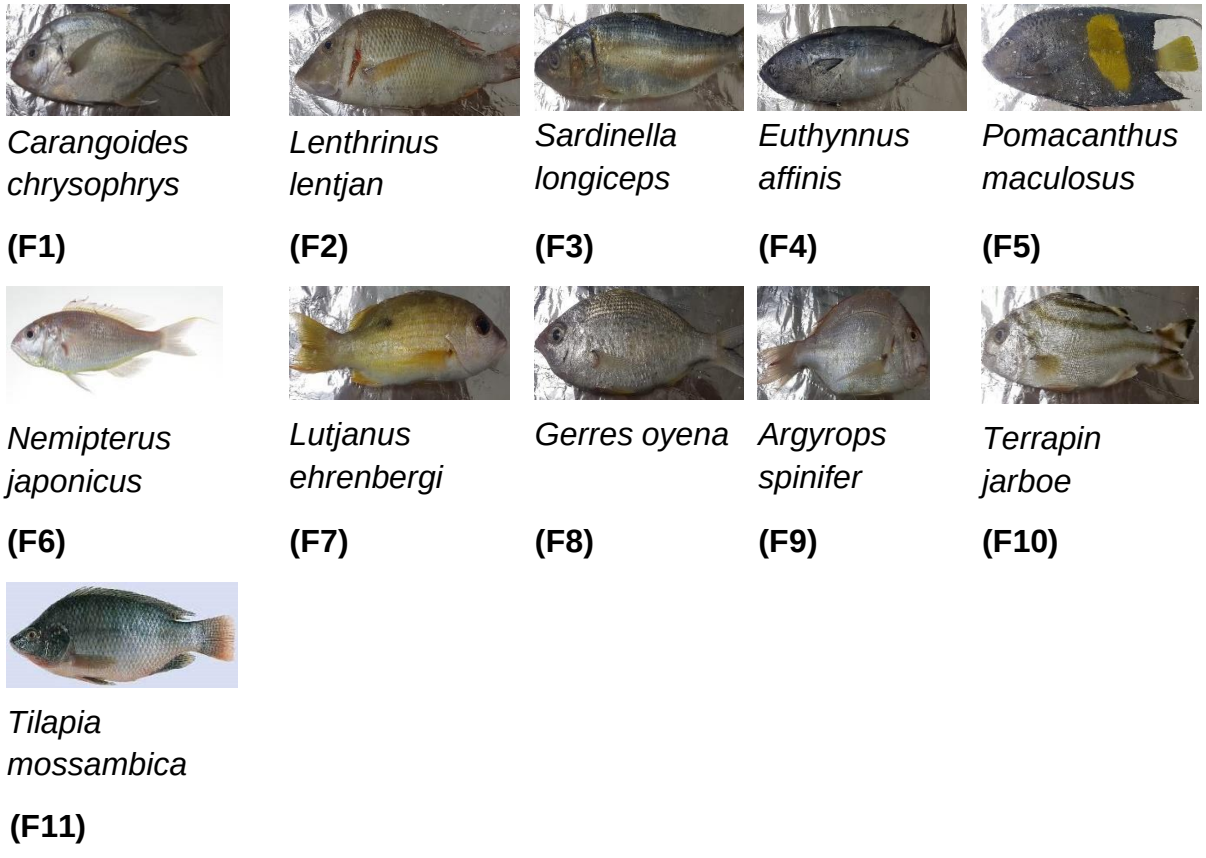


**Figure 2. Different species of fish used for protein analysis**

### Chemicals

The chemicals used in the present investigation were of analytical grade and of high purity from Merck. Standard used for analysis were purchased from Germany and USA.

### Preparation of sample for Protein analysis

### Ghaf

The samples (leaves) were washed with sterile water. Weighed 10g of sample (each) by analytical balance (RADWAG-PS 2100.R2, Poland) and transferred it into sterile mortar pestle and then grounded the sample (Figure 3) to make a clear fine solution (AlGhais et al 2020)[5].

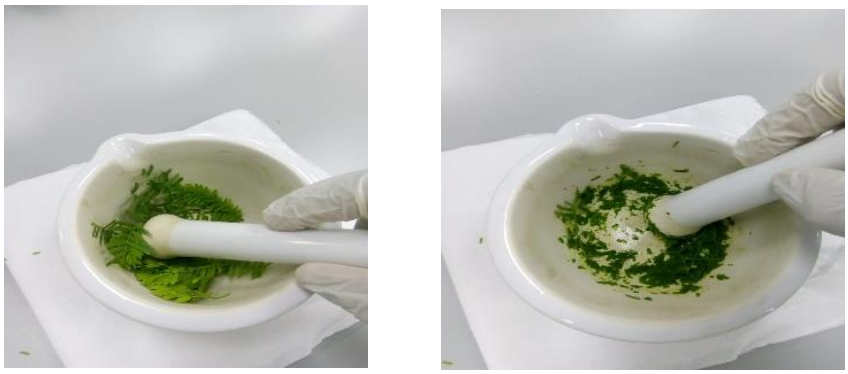

**Figure 3. Sample preparation for Protein Analysis**

**Fish**

Protein was estimated by the method of Lowry et al, 1951[6]. Muscle homogenate (5% w/v) was prepared in ice-cold distilled water with the help of homogenizer. 0.2 ml of tissue homogenate was mixed with 1.3 ml of distilled water and 0.5 ml of 20% trichloroacetic acid to precipitates proteins. The tubes were allowed to stand at $4^0$C for 30 minutes and centrifuge at 2500 rpm to sediments protein precipitates.

The sediments were dissolved in 0.1N sodium hydroxide solution. A suitable aliquot of protein solution thus obtained was taken out in another tube and made up to 0.5 ml with reagent A. Then, 2.5 ml of reagent C was added and shaken. After 10 minutes 0.25 ml of Folin & Ciocalteus Phenol reagent was added. After 30 minutes the blue colored solution was appeared and measured at 660 nm by Spectrophotometer (AlGhais et al 2018 and 2019)[7,8].

**Statistical analysis**

All experiments were doing in triplicate. Data are expressed as mean. Pair wise comparisons were performed. Experimental error was determined for triplicate assays and expressed as standard deviation (SD).

**Results and Discussion**

This is probably the first research report of comparison of ghaf protein content with different species of fishes. In the present investigation the leaves of ghaf and muscles of fish were used for protein content analysis. All experiments were doing in triplicate (Table 1).

According to the present research findings, *Euthynnus affinis* showed highest protein 137.5 mg/g. The other fishes muscle protein were *Carangoides chrysophrys* (43.33 mg/g), *Lenthrinus lentjan* (105 mg/g), *Sardinella longiceps* (104.17 mg/g), *Pomacanthus maculosus* (81.67 mg/g), *Nemipterus japonicus* (111.67 mg/g), *Lutjanus ehrenbergi* (99.17 mg/g), *Gerres oyena* (107.5 mg/g), *Argyrops spinifer* (100.83 mg/g), *Terrapin jarboe* (82.5 mg/g), *Tilapia mossambica* (54.72 mg/g). Ghaf tree is a keystone species having multiple beneficial uses from combating desertification and improving soil fertility in arid environments to being an essential food source, as well as a source of fuel, shelter and medicine for both humans and animal species. The Ghaf leaves extracts were tested for protein content analysis. The protein content in Ghaf leaves was found to be 88.61 mg/g. Thus, the research results revealed that Ghaf leaves has almost similar amount of protein as compared to fish muscle protein and can be used as protein supplement for growth and metabolism of body (Figure 4).

**Table 1. Protein content of Ghaf leaves compared with different (11) species of fish**

| Fish sample (F) | Protein content (mg/g) |
|---|---|
| F1 | 43.33 |
| F2 | 105 |
| F3 | 104.17 |
| F4 | 137.5 |
| F5 | 81.67 |
| F6 | 111.67 |
| F7 | 99.17 |
| F8 | 107.5 |
| F9 | 100.83 |
| F10 | 82.5 |
| F11 | 54.72 |
| Ghaf | 88.61 |

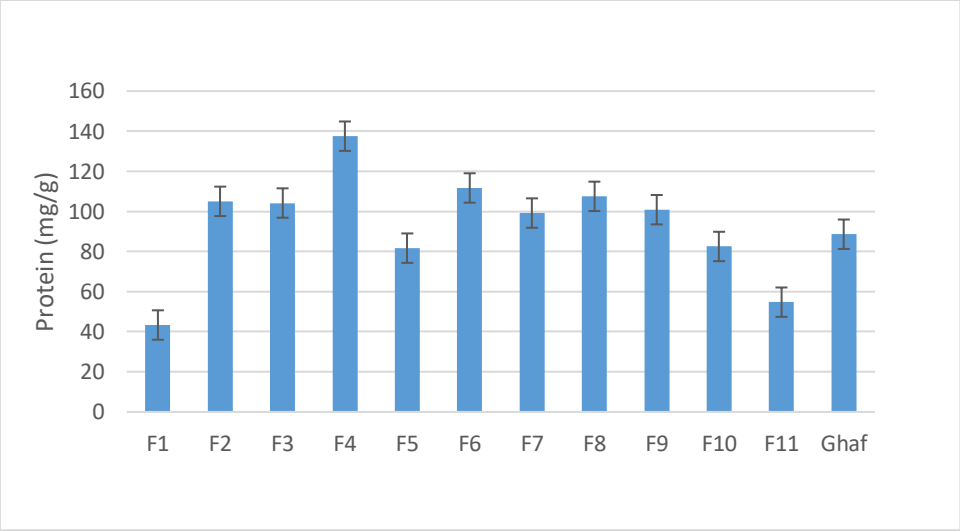


**Figure 4. Graphical Comparison of protein content between Ghaf and different fish species**

According to our previous study ghaf is a potential desert nutraceutical (AlGhais et al 2020)[5]. Ghaf tree leaves contains higher amount of iron, magnesium, calcium, sulphate, potassium as compared to spinach and lettuce. Similar information was reported by Balogun et al, 1986, that *P. cineraria* have 16.5–18.25% protein content compared with 25.47% in *Acacia nilotica* and 38.89% in *Acacia Senegal*. According to Cattaneo et al 2016[9], the *Prosopis* flour contains a high level of proteins (62%), dietary fiber (25%) and low content of total carbohydrate and fat in addition to dominant amounts of free polyphenol and carotenoids compounds. *Prosopis* flour is gluten-free, and a premium source of calcium, potassium, magnesium, zinc, and iron, in addition to amino acids such as lysine that is low in other cereals (Pasiecznik et al; 2004 and Saura-Calixto, 1999)[10,11].

## Conclusion

*P. cineraria* is a naturalized constituent of many natural and cultivated ecosystems in the world. Besides the ecological value of *P. cineraria* tree, there are significant utilizations centered on its use for human food, animal feeds, medical purposes and many other applications.

According to the results of analysis, this significant tree can be used as a source of protein supplement in diet. The ghaf leaves are full of protein content as similar to fish protein. So, ghaf tree leaves can be used as food product and this will help the society, to meet the increasing demand of protein, and unconventional sources of protein for human and animal nutrition.

Future efforts are required to be focus on implementation of environmental conservation strategies for achieving sustainable uses of *P. cineraria* and maintain its benefits to livelihood and coming generation and can be used in value added products.

## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data and materials

The relevant data and materials are available in the present study.

## Competing interests

The authors declare that they have no competing interests. All procedures followed were in accordance with the ethical standards (institutional and national).

## Funding

Not applicable.

## Acknowledgements

Authors would like to thank all individuals who provided their efforts for this research**.**

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