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Studies on some Egyptian foods

Part 1: Biochemical and biological evaluation

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With 2 tables

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The magnitude of the protein problem in Egypt directed the researches towards the re-evaluation of the different local sources of protein in an attempt to improve the quality of the individual protein intake. The Food Balance Sheet (1) reported that the daily individual share of total protein is about 94.9 g/day. However, the individual share of animal protein is only 13.3 g. Proteins of plant origin constitute over 85 % of overall available proteins. In order to raise the per-caput animal protein consumption to meet that of developed countries, this will require millions of Egyptian pounds worth of meat every year which is partially impossible, and fortunately unnecessary if great attention is paid towards increasing production and consumption of plant proteins, especially legumes. For this reason it was thought desirable to investigate the chemical constituents of some common protein-rich foods, besides the biological studies of their proteins. The food items chosen were lupinus termis and fenugreek seeds. The present study covered the following:

- General analysis of the selected legumes.
- Biological value of their proteins.

Materials and methods

Lupinus-termis and fenugreek seeds were chosen because they are largely consumed in Egypt. The lupinus is eaten throughout the year, more frequently by the middle and poor classes. Lupinus-termis seeds contain considerable quantities of proteins and thus may favourably supplement the proteins of the basal diet of the people. Fenugreek seeds are also important legumes in the Egyptian diet. Fenugreek is consumed in various ways.

Preparation of sample: Samples were prepared as they are consumed by humans. Three varieties of lupinus termis *Guiza (1)*, *Guiza (2)* and *Balady*, and fenugreek seed *Guiza (30)* were used. The lupinus-termis seeds were soaked for 12 hrs in running tap water, then washed and boiled in water for 1 hour. The seeds were washed again and steeped in running water for 4 days to remove its natural bitterness. The testa were removed from the seeds, then subjected for chemical and biological experiments.

Preparation of fenugreek seeds was done either by roasting or by germination. Seeds were roasted in an electric oven at 150 °C for 40 min, then ground to a very

fine powder by blender. To prepare the germinated seeds, samples were soaked in water for 24 hrs, then germinated for 4 days in special clay bowls, manufactured and used locally specially for fenugreek germination. All samples were analyzed for their chemical constituents. The method used for evaluating protein quality included the evaluation through growth methods:

- Protein Efficiency Ratio (PER) and
- Net Protein Ratio (NPR)

The following chemical determinations were done: moisture, total nitrogen, fat, ash, and fiber content according to the AOAC method (2). Carbohydrate was calculated by difference. Calcium was determined by the method of Tisdall (3). Determination of phosphorus was carried out according to the AOAC (2). Iron also was determined using the method of Elvehjem (4).

Determination of PER: Experiments were carried out using weanling albino rats, 28 days old, and their body weight ranged between 35 and 40 g. Rats were divided into groups of 6 animals each, housed in individual metabolic cages. The groups were equalized with respect to sex and weight. Animals were fed individually with the various experimental diets.

Normal diet composed of 70 % corn starch, 10 % casein, 10 % cotton-seed oil, 5 % cellulose, 4 % salt mixture (5), and 1 % vitamin mixture (6).

Experimental diet: modified normal diet, but containing no casein, its protein content was that of tested protein.

Non-protein diet: modified diet similar in composition to the control diet, but containing no protein. Rats were fed this diet for 14 days only in order to determine the loss of weight corresponding to the maintenance requirement of rats.

Rats were weighed weekly for 4 weeks. The PER was calculated as:

$$\frac{\text{gain in body weight (g)}}{\text{protein intake (g)}}$$

Net protein ratio (NPR) was calculated as follows:

$$\frac{\text{weight gain of tested protein group} - \text{weight loss of the control}}{\text{protein intake}}$$

Results and discussion

Table 1 shows the general chemical analysis of the tested legumes. It is recognized that there is a mild variation among the three species of

Table 1. Biochemical components of lupinus termis and fenugreek seeds.

	Lupinus termis				Fenugreek seeds	
	Guiza 1	Guiza 2	Balady	Raw	Roasted	Germinated
Moisture %	70.06	72.10	71.09	09.02	05.12	77.61
Total Protein %	15.11	15.90	15.70	30.12	32.41	07.65
Fat %	3.30	2.65	2.80	6.52	7.07	1.12
Carbohydrate %	10.16	8.11	9.21	46.25	47.63	10.55
Fiber %	0.75	0.67	0.58	4.51	4.46	2.44
Ash %	0.60	0.55	0.50	3.32	3.31	0.63
Calcium mg/100 g	292	285	280	199	207	148
Phosphorus mg/100 g	425	448	440	365	381	300
Iron mg/100 g	10.5	11.5	10.5	21.8	22.7	18.4

lupinus termis. However, a slight increase in carbohydrates and fats was recorded in *Guiza* (1). Of course, this increase was on the expense of total protein. Comparing the results of this study with other studies, it was found that results keep pace with those reported by *El-Hawary* (7), who analyzed the same types of Egyptian lupine.

Results also show that raw fenugreek seeds contain a high percent of protein. These results are in agreement with *Abdou* et al. (8) and *Abdou* (9). All kinds of *termis* and fenugreek seeds contain high amounts of calcium and phosphorus. These amounts are of great value when compared with that present in meat, egg, and milk. Fenugreek seeds contain also a good amount of iron. The position of lupine and fenugreek as a food source for minerals is shown when compared with other food stuffs.

Table 2. The PER and NPR of *lupinus termis* and fenugreek seeds.

Meal	PER	NPR
Casein	2.18	3.64
Lupinus termis (<i>Guiza</i> 1)	1.37	2.85
(<i>Guiza</i> 2)	1.39	2.70
(<i>Balady</i>)	1.40	2.52
Fenugreek seeds (raw)	0.73	2.36
(roasted)	1.21	2.74
(germinated)	1.35	2.77

Table 2 shows the Protein Efficiency Ratio (PER) and the Net Protein Ratio (NPR) of the tested proteins. In most samples, the PER ranged from 1.21 to 1.40 with no significant difference as due to the different varieties of *termis*. In the case of raw fenugreek seeds, a lower figure was reported. This may be due to the effect of toxic substances of growth inhibitor factors (alkaloid trigonine). Roasted seeds gave higher PER values than raw seeds. This may be due to heat treatment which decreased the toxic substances. In case of germinated seeds, results showed an increased PER value. This is a result of getting rid of toxic substances by soaking the seeds before germination, as well as the effect of the biochemical changes occurring during germination.

Net Protein Ratio (NPR) value for raw fenugreek seeds is lower than that for prepared seeds. The data for NPR values showed an increase higher than that of PER, because of its consideration to the maintenance effect of the protein besides its growth-stimulant function.

Summary

General chemical analysis of some Egyptian legumes (*lupinus termis* and fenugreek seeds) and biological evaluation for their proteins were investigated. Results showed that *lupinus termis* and fenugreek seeds have high protein contents (with the exception of germinated fenugreek). They are good sources of calcium and phosphorus. Raw seeds gave low PER and NPR values. However, these values increase after roasting or germination.

References

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