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Nutritive value of Geotricum candidum yeast prepared from decaying fruits in Egypt

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With 2 tables

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The yeast *Geotricum candidum* contains 32 g. crude protein, 12.7 g. ethereal extract and 37.2 g. total carbohydrates per 100 g. dry weight. The amino acid pattern of this yeast was investigated. 18 amino acids among which all the essential ones were detected. Animal feeding experiments showed that the yeast has poor digestibility which was attributed to the high amount of purine in the dried cells. Pathological examination of different organs did not reveal any morphological or pathological changes.

Since the beginning of this century, dried yeast was recognized as a valuable protein rich food.

In Egypt where the conventional sources of protein are still limiting, the utilization of nonconvential sources such as yeasts will be a feasible solution to overcome such a problem.

The yeast most commonly employed for food or fodder production is a strain of the organism *Torulopsis utilis* (1). However, other yeasts have been commercially used such as *Torula pulcherima, Monilia candida, Candida arbora, Oidium lactis* and *Oespora lactis (G. candidum)* [*Prescott* and *Dunn* (1)]. *Watanabe* (2) reported that *Geotricum candidum* is very promising as a producer of protein feed for animals.

1. Experimental

1. Preparation of the yeast

Geotricum candidum, isolated from decaying fruits in Egypt, was cultivated on a synthetic medium formulated by *Osman, Shenouda,* and *El-Masry* (3). Culturing was conducted in 10 litres flasks, containing 4 litres liquid medium aerated to a rate of 0.7/v/min., with occasional shaking to keep the yeast mycelia almost at a uniform density. The flasks were incubated for 4–5 days at 29° C. After incubation period, the culture was examined microscopically to exclude any contamination. The cells were harvested by centrifugation. The harvested crop was washed twice with distilled water and dried at 60° C. The dried yeast was then ground and stored in dark bottles at 4° C for feeding experiments.

2. Analysis of dry yeast

Chemical analysis of the dry yeast for total nitrogen and ethereal extracts was carried on, following the methods adopted by A.O.A.C. (4).

3. *Amino acid estimation*

The amino acid pattern and contents of the yeast were determined after being hydrolysed with 6-N-HCl according to *Khan* and *Baker* (5). Measured amounts of the acid hydrolysates were spotted on whatman No 1 filter paper. Ascending paper chromatography technique was carried out using the buffered method of *Levy* and *Chung* (6). Cystine and methionine were oxidised with performic acid, then determined according to the method of *Jamalian* and *Pellet* (7). The colorimetric method of *Blauthi, Charezinski* and *Berbec* (8) was followed for estimation of tryptophan in the alkali hydrolysates.

4. *Determination of net protein utilization*

The net protein utilization of the yeast and casein diets were determined according to the method of *Miller* and *Bender* (9), using weanling Sprague-Dawly albino rats. The total protein level was maintained at 10 % of the diet. The composition of the diets used in the experiments are shown in tab. 1. The digestibility and biological values were calculated.

Tab. 1. Compositions of the experimental diets g./100 g.

Constituents	Non protein diet	Casein diet	Yeast diet
Casein	–	11.5	–
Dry yeast (*G. candidum*)	–	–	31.3
Cooking fat	7.5	7.5	7.5
Corn oil	7.5	7.5	7.5
Corn starch	50.0	48.5	28.7
Potato starch	10.0	–	–
Glucose	15.0	15.0	15.0
Vitamin mixture*	5.0	5.0	5.0
Salt mixture*	5.0	5.0	5.0

* Vitamin and salt mixtures were prepared according to *Miller* and *Bender* (9).

5. *Pathological examination of different organs of the experimental rats*

Two groups of rats which were fed on the casein and yeast diets for six weaks, were autopsied and certain organs (liver, intestine, spleen and kidney) were separated and prepared for histopathological examinations. Ordinary paraffinic sections stained with haematoxylin and eosin were prepared from the organs to detect any histopathological changes.

2. Results and discussion

1. The chemical analysis of 5 samples of yeast showed that the mean values of crude protein, ether extract and carbohydrate were 32 %, 12.7 % and 37.2 %, respectively.

2. The following amino acids were identified in the dried yeast hydrolysates, cystine, lysine, histidine, arginine, aspartic, serine, glycine, threonine, glutamic, alanine, proline, tyrosine, α aminobutyric, valine, methionine, tryptophan, phenyl alanine and leucine + isoleucine. Their

Tab. 2. Amino acid content of *G. candidum* compared with the essential amino acid pattern recommended by the FAO

Amino acid	*G. candidum* mg./g.N.	FAO pattern mg./g.N.
Cystine	91	126
Lysine	419	270
Histidine	231	–
Arginine	337	–
Aspartic	934	–
Serine	235	–
Glycine	263	–
Threonine	290	180
Glutamic	844	–
Alanine	410	–
Proline	308	–
Tyrosine	125	180
Aminobutyric	122	–
Valine	354	270
Methionine	110	144
Tryptophan	79	90
Phenyl alanine	259	180
Leucine + Isoleucine	368	576

quantities expressed in mg./g. nitrogen, are also shown in tab. 2, which are comparable to that of other fodder yeast studied by *Mojonier* et al. (10). The essential amino acids content of *Geotricum candidum* were compared with the provisional amino acid pattern recommended by the FAO, for human consumption (11). *G. candidum* is rich in the essential amino acid lysine, while sulphur amino acids are the most limiting amino acids.

3. On comparing the net protein utilization of *G. candidum* incorporated in a synthetic diet (at a 10 % protein level) with that of casein at the same protein level, it was found to be 31 while that of casein was 57. These values are comparatively lower than those previously reported by *Miller* and *Bender* (9). Calculating the biological value of the yeast and casein diets, it was found to be 49 and 63, respectively. These data are more or less similar to those previously reported by *Skaklady* (12). The yeast has poor digestibility "64" as compared to that of casein "92". Such poor digestibility could be due to the high percentage of purines in dried yeast (13).

Such low values for protein utilization and biological value may be due to:

a) deficiency of the yeast protein in sulphur containing amino acids;
b) the presence of high amounts of purines in the yeast.

4. The pathological examination of different organs from animals fed on casein and yeast for more than 21 days showed that the yeast *G. candidum* did not cause any morphological or pathological changes in the

organs studied. Testing for glycogen in the liver of animals using *Hotchkiss* dye (14), it was found that animals fed on yeast diet accumulated more glycogen than those fed on casein diet.

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