

*Nutrition Laboratory, National Research Centre, Dokki, Cairo (Egypt)*

## **Improvement of Supramine and development of new food mixtures for the young**

### **I. Improvement of Supramine**

*S. M. Hegazi and F. A. El-Shobaki*

With 1 figure and 4 tables

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In developing countries, one of the main nutritional problems is the shortage in protein supply to satisfy the increasing demands of the growing children. Protein-rich food mixtures from locally available low-cost food ingredients proved to be successful in solving this problem in many countries (1, 2, 3, 4, 5).

Supramine is a protein-rich food produced since 10 years in Egypt by El-Nil Pharmaceutical Company supported by the UNICEF. The product consists of chickpeas, lentils, wheat flour, skimmed milk, sugar and some vitamins. It contains 20 % protein and is relatively the cheapest in the Egyptian market relative to other similar products.

Unfortunately, Supramine suffers from two main problems, which limit its distribution in the market. It is relatively less palatable than other similar products and its shelf life is shorter.

The present work entails the trials made to overcome these two problems to render Supramine palatable and of longer shelf life.

#### **Material and methods**

Supramine is formulated from chickpeas (36 %), lentils (17 %), wheat flour (26 %), skimmed milk (11 %), sugar (9 %), and vitamins A and D (1 %). In the factory, Supramine is manufactured as follows: chickpeas and lentils are washed, then dried in air-circulating ovens and milled to fine powder. The powder is mixed with the suitable proportion of wheat flour and water together with takadiastase enzyme to form a paste. The paste is introduced into ovens with flat movable plates regulated at 70 °C for a period of about 1 hour. Afterwards, the semi-dried flakes are shifted to another drying oven regulated at 90 °C for another period of 1 hour till dryness. The dried flakes are milled, then mixed with skimmed milk, sugar, and vitamins and packed in cellophane bags.

The following was done to improve the palatability of Supramine and prolong its shelf life.

##### *1. Pretreatment of the ingredients including*

###### *a) Autoclaving*

The chickpeas or lentils were mixed with water (1 kg : ½ litre water), then autoclaved at 100 °C for ½ hour. The autoclaved ingredients were dried in an air-circulating oven at 60 °C, then milled in a suitable grinder to a fine powder.

**b) Roasting**

The chickpeas or lentils were roasted on the oven for a period of ½ hour with continuous stirring.

**c) Boiling**

The ingredients were mixed with water in the same proportions as in the case of autoclaving and boiled on the oven for a period of 1 hour, dried as before and milled.

**2. Assessment of conditions for enzyme action (fig. 1)**

Two experiments were done.

- a) The ingredients chickpeas, lentils, and wheat flour were mixed with water in the proportions mentioned before for preparation of Supramine. The sample was divided into two portions. The enzyme was added with two concentrations 0.1 % to one portion and 0.2 % to the other.
- b) Another mixture of the same ingredients was prepared as before. The enzyme at a concentration of 0.1 % was added and the sample was divided into five portions. Each was incubated in a different oven regulated at 45, 50, 55, 60 and 70°C.

Samples of the mixture of either experiments a or b were withdrawn at intervals of 15, 30, 45, 60, 75, 90, 105 and 120 minutes. The enzyme activity was determined in each according to the procedure described by *Abelson and Vogel* (6).

The procedures followed for the general analysis of the preparations were followed according to the O.A.A.C (7). The amino acid pattern of the preparations was done by paper chromatography according to *Levy and Chang* (8) (table 3). The mineral content was estimated in the ash by Atomic Absorption Spectrophotometry (Model Zeiss PM6) (table 4).

Complete microbial analysis was done for the ingredients formulating Supramine before processing and after formulation of the mixture. Examination of the possible occurrence of insects' larvae or eggs was performed during different intervals till six months of shelf storing at room temperature in tightly closed glass bottles.

**Results and discussion**

Ten mixtures could be formulated composed of the same ingredients of Supramine after different pretreatments or by addition of new components. The composition of these mixtures is shown in table 1.

The treatments or modifications done to formulate these mixtures is as follows:

- Mixt. 1: Autoclaved chickpeas + autoclaved lentils, mixed with wheat flour, skimmed milk, sugar, and vitamins.
- Mixt. 2: Chickpeas and lentils autoclaved together, then mixed with wheat flour, skimmed milk, sugar, and vitamins.
- Mixt. 3: Autoclaved chickpeas, autoclaved lentils, parboiled wheat, added with skimmed milk, sugar, and vitamins.
- Mixt. 4: Autoclaved chickpeas + autoclaved lentils, added with flour, then the enzyme, incubated, dried and then mixed with skimmed milk, sugar, and vitamins.
- Mixt. 5: Autoclaved chickpeas + autoclaved lentils mixed with dried bread (Fino) and the enzyme, incubated, dried, then mixed with skimmed milk, sugar, and vitamins.

Table 1. Composition of the modified Supramine mixture (amounts in grams in 100 g mixture).

Mixture No.	Chick peas	Lentils	Wheat flour	Parboiled wheat	Bread	Semolina	Skimmed milk	Sugar	Vitamin
1	36	17	26	-	-	-	11	9	1
2	36	17	26	-	-	-	11	9	1
3	36	17	-	26	-	-	11	9	1
4	36	17	26	-	-	-	11	9	1
5	36.0	13	-	-	26	-	15	9	1
6	36	17.4	21.6	-	-	-	15	9	1
7	33	12	25	-	-	-	20	9	1
8	30	14	-	-	-	27	19	9	1
9	30	14	-	-	-	27	19	9	1
10	36	15	15	-	12	-	12	9	1

- Mixt. 6: Autoclaved chickpeas + autoclaved lentils mixed with wheat flour, treated with the enzyme, incubated and dried, then mixed with skimmed milk, sugar, and vitamins.
- Mixt. 7: Roasted chickpeas and roasted lentils, then prepared in the same way als mixt. no. 6.
- Mixt. 8: Roasted chickpeas + roasted lentils mixed with semolina, skimmed milk, sugar, and vitamins.
- Mixt. 9: Same as mixt. 8, but treated with takadiastase enzyme.

Table 2. Chemical composition of formulated food mixtures compared with Supramine and other food mixtures (g/100 g).

Mixture No.	Moisture	Protein	Fat	Crude fibre	Ash	Total hydrolysable carbohydrate
1	8.0	20.28	2.60	2.30	2.5	64.42
2	8.0	18.56	2.65	2.16	2.6	66.01
3	8.3	19.05	2.47	2.17	2.6	65.41
4	8.6	19.59	2.60	2.18	2.6	64.44
5	8.5	19.60	2.30	2.01	2.7	64.85
6	8.4	20.13	2.40	2.08	2.6	64.39
7	8.3	20.36	2.29	1.83	3.2	64.06
8	8.3	21.16	2.05	1.82	2.9	63.77
9	8.6	22.2	2.03	1.97	3.1	62.09
10	9.1	18.40	2.44	1.88	2.7	65.48
Supramine	3.0	20.49	2.6	2.4	2.8	68.70
Beledine	2.9	4.09	0.65	-	0.4	91.94
Ceralac	1.3	10.94	2.5	-	1.70	83.56

Table 3. Amino acid composition of prepared mixtures (mg/gN).

Amino acid	Supramine	Mixt. 4	Mixt. 5	Mixt. 7	Mixt. 9	Mixt. 10
Aspartic acid	579	705	435	671	829	650
Glutamic acid	823	994	1004	1176	963	993
Glycine	244	273	255	256	242	272
Serine	214	231	217	246	200	258
Threonine	223	256	255	234	239	272
Alanine	204	205	198	203	197	235
Tyrosine	232	320	290	307	309	245
Valine	278	315	319	277	338	332
Phenylalanine	340	320	312	338	279	373
Leucine + Isoleucine	630	726	697	687	663	725
Lysine	310	352	330	308	309	329
Arginine	274	272	287	258	284	332
Histidine	216	256	220	280	257	211
Methionine	80	82	92	101	100	96
Cystine	72	74	75	78	71	73
Tryptophan	113.0	122	192	160	137	151

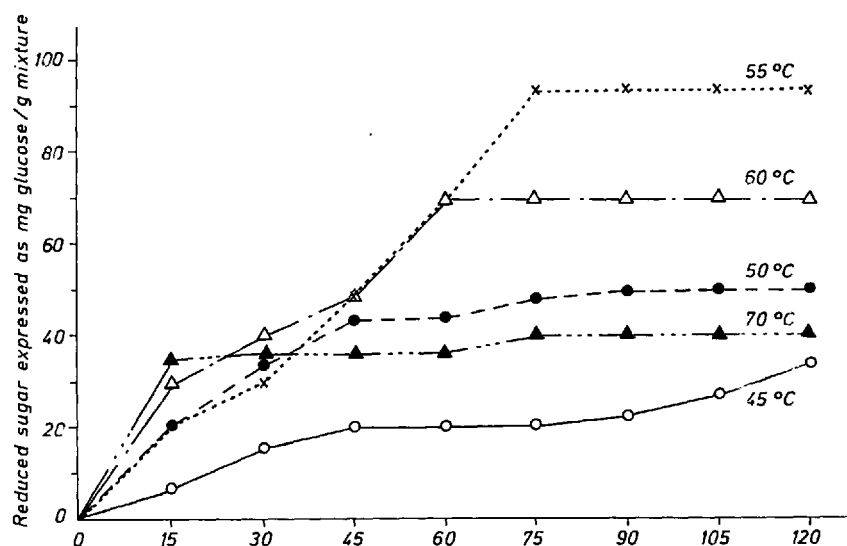
Table 4. Mineral contents of prepared mixtures (calculated al mg/100 g mixture).

Mixt. No.	Phosphorus P	Iron Fe	Copper Cu	Zinc Zn
1	342	13.2	0.76	0.95
2	305	13.0	0.59	1.04
3	585	11.4	0.58	1.15
4	258	10.5	0.52	1.06
5	436	7.0	0.77	1.08
6	423	6.6	0.68	1.10
7	153	6.0	0.54	1.06
8	233	5.0	0.53	1.01
9	245	5.8	0.67	1.02
10	159	6.9	0.60	1.04

Mixt. 10: Roasted chickpeas and roasted lentils mixed with flour and cooked rice, treated with the enzyme, dried and mixed with skimmed milk, sugar, and vitamins.

Heat treatment of chickpeas or lentils either by autoclaving, cooking or roasting caused a marked improvement in the taste of the product. This was confirmed by a preliminary panel test made on ladies, staff members in the Department of Food Science and Nutrition. Most of them are mothers. Chemical analysis proved that such treatments have little or no effect on the protein content or the amino acid pattern of the ingredients.

The enzymatic study done proved that takadiastase enzyme exerts its maximum effect under our conditions at 55 °C and an operation period of 75 minutes. 0.1 % concentration of the enzyme exerted more or less the



same effect as 0.2 %, which favour the use of 0.1 % concentration for economic reasons.

It is worth mentioning that the developed ten mixtures have more or less the same content of protein as Supramine. In addition, they are more palatable. The adjustment of the conditions for enzyme action helped a lot in transformation of the starchy material into simple sugars. Also, the heat treatment which causes the rupture of the cellulosic material of cell membranes is expected to render the product more digestible. The replacement of wheat flour with semolina in mixt. no. 3 markedly improved its palatability. Raising the quantity of skimmed milk in mixtures no. 7, 8, 9 and 10 made the product more soft and palatable.

Investigations of the specimens of food mixtures prepared in the laboratory and stored over a period of six months revealed the absence of any eggs, larvae, or insects. This indicates that the short shelf life of Supramine may be due to contamination of the ingredients during storing or transport. The heat treatment we did to these ingredients before mixing minimized infection and in turn prolonged the shelf life of the product prepared in the laboratory.

It is planned to apply these modifications in the Supramine factory to develop the product and make it more palatable. The presence of more than one formula ready for production will be of advantage to satisfy the different sectors of consumers. Being the cheapest food mixture in the local market, it will be a good source of protein within the reach of our children.

### Summary

Supramine, a food mixture produced in Egypt by El-Nil Pharmaceutical Company supported by UNICEF. The product suffers from two problems: It is not well liked by the children, and its shelf life is relatively short. Studies were made to overcome these problems. Pretreatment of the ingredients such as cooking, autoclaving or roasting markedly improved palatability of the product. Adjustment of the conditions of the enzyme action increased hydrolysis of the starchy material making the product more soft and digestible. Formulation of new mixtures gave the chance to the product to satisfy the wish of a wide sector of the consumers. The heat treatment made to the ingredients minimized contamination and prolonged shelf life of the product.

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### Authors' address:

Dr. S. M. Hegazi, Nutrition Laboratory, National Research Centre, Dokki, Cairo (Egypt)