INSTITUT PASTEUR DE LILLE

FONDATION RECONNUE D'UTILITE PUBLIQUE

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VITAPRO

LA NUTRITION DE L'AVENIR

PASTEUR INSTITUTE OF LILLE

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VITAPRO

THE FOOD OF THE FUTURE

I - The soybean's place in our diet

The soybean, already used as a food for a thousand years, will still be one of our key foods in the year 2000.

The world's leading oilseed, the yellow soybean (Glycine Maxima) is one of the most important elements of world trade. World soybean production is of the order of 100 million tonnes, mainly destined for use as animal fodder. Half of this production comes from the United States, and 200,000 tonnes from France.

Soybean production is environmentally friendly, since it requires little use of fertilizers or pesticides. The direct use of soybeans in foods for humans makes it possible to eliminate animal products from the production chain for proteins, with greater productivity than that for any other vegetable-based source of protein, not to mention animal sources.

The soybean is presently used as the basis for a range of foods which are well adapted to consumers' concerns for health and a balanced diet.

Soy-based food products have variable nutritional composition depending on their nature and manufacturing process. Some are mainly made up of proteins, others of fibres, while still others contain all the bean's constituents, modified by the physical transformations of the manufacturing process. Their role in human nutrition is the object of a growing number of studies.

The soybean's composition by weight is 36% proteins, 18% lipids, 14% glucides, 18% fibres and 4.5% minerals.

II - The role of soya proteins in nutritional balance

Our dietary intake is characterized by an excess of proteins, in particular animal proteins. The latter ought to be reduced, and replaced in part by vegetable proteins.

The soybean's value lies in its capacity to supplement cereal proteins effectively, as most of the world's alimentary traditions realize intuitively, associating legumes such as soya, and even small quantities of animal proteins, with cereals (rice, wheat, corn, sorghum, millet, ...). Of course one

recognizes that the recommendation of a ratio of animal to vegetable protein equal to 1 is only a theoretical notion (the real ratio is currently 3 to 4). It could be lower and still satisfactory, for example 0.5, depending on the nature of the proteins selected.

The calculation of global nitrogenated efficiency is the result of the product DUC BV and represents net protein utilisation (NPU). The DI-SCO index is close to this parameter: real digestibility (%) * chemical index (%). Soya's DI-SCO index is 99, the highest of all vegetable proteins.

Note: DUC = Digestive Utilisation Coefficient; BV = Biological Value.

Soya's components thus have nutritional properties which allow soya-based food products to play a favourable role in a balanced diet. They help us to approach the nutritional recommendations.

The soya alternative consequently provides one dimension of dietary diversification. The restaurant industry can contribute to public knowledge and promotion of this food by offering varied and original recipes.

III - VITAPRO in dietary balance

VITAPRO is a particular presentation of soybeans transformed by a well-developed texturing technology.

Among VITAPRO's ingredients are soya flour and textured soya proteins.

There are two versions of VITAPRO: beef-flavoured VITAPRO and chicken-flavoured VITAPRO. With these two flavours, VITAPRO is positioned as a meat substitute.

IV - VITAPRO's nutritional qualities

Proteins

Soybeans are very rich in proteins, with one of the highest protein contents in either the vegetable or the animal world. The soybean's average protein content is 36% (Table I).

In comparison, meats and fish are about 18-20% protein, while cereals have around 9%.

Nevertheless, interest in soya due to its richness in proteins on a quantitative level is reinforced by an appreciation of the food's protein content, which depends in particular on its profile of essential amino acids (determined by the food's chemical index) (Tables II and III).

Beef-flavoured VITAPRO contains 31% protein, a particularly high level.

Its profile of essential amino acids is altogether appropriate. All the essential amino acids, with a single exception, are present in ideal proportions when compared to a so-called reference protein.

Beef-flavoured VITAPRO is slightly deficient in high-sulphur amino acids, namely methionine. It is thus a food which can substitute for animal-based protein-rich foodstuffs, but whose protein-oriented effectiveness will be improved by a complementary association with cereal-based foods, or with animal-based protein sources included in small quantities in the same meal.

Chicken-flavoured VITAPRO contains 24% protein.

While this level is below that of beef-flavoured VITAPRO, it is still quite high and altogether worth considering. Its essential amino acid profile is similar to that of beef-flavoured VITAPRO and reflects the same deficiency in methionine. The same suggestions for its use may be envisaged.

Recipes generally propose 25 g. of dehydrated VITAPRO per person, or 125 g. when reconstituted. This is equivalent to the meat content of a typical menu.

This suggested quantity contributes 6 g. (chicken-flavoured VITAPRO) to 8 g. (beef-flavoured VITAPRO) of proteins per person.

It is thus desirable that the remainder of the menu or of the meal should contribute a complementary quantity of protein to achieve a total of approximately 25 g. per meal (calculated on the basis of a diet of 2000 Kilocalories per day, to include 12% protein, that is 60 g. of protein per day, of which 25 g. at mid-day and evening, and 10 g. in the morning).

At the same time, this composition implies a qualitative improvement in the meal's protein content.

To achieve this goal, one may make use of other sources of vegetable protein such as cereals (bread, rice, semolina, pasta, ...), or animal protein (milk products, small amounts of fish, eggs, ...). With these different types of combination, the concept of a mainly vegetarian diet is maintained, while remaining correctly balanced and without any doubt economical.

Examples of meal structures balanced in proteins

Beef-flavoured VITAPRO

Structure 1	Structure 2	Structure 3	Structure 4
VITAPRO 25 g.	VITAPRO 25 g.	VITAPRO 25 g.	VITAPRO 25 g.
+	+	+	+
cheese 30 g.	fish 50 g.	1 egg	milk products 125 g.
+	+	+	+
bread 40 g.	milk products 125 g. (yoghurt, cream cheese)	milk products 125 g.	bread 40 g.
+	+	+	+
cereals 30 g. (rice, pasta, semolina, ...) (uncooked)	cereals 50 g.	cereals 50 g.	cereals 50 g.

The protein content of these structures ranges from 21 to 27 g., or 24 g. on average.

Chicken-flavoured VITAPRO

Structure 1	Structure 2	Structure 3	Structure 4
VITAPRO 25 g.	VITAPRO 25 g.	VITAPRO 25 g.	VITAPRO 25 g.
+	+	+	+

cheese 30 g.	fish 50 g.	1 egg	milk products 125 g.
+	+	+	+
bread 50 g.	milk products 125 g. (yoghurt, cream cheese)	milk products 125 g.	bread 50 g.
+	+	+	+
cereals 30 g. (rice, pasta, semolina, ...) (uncooked)	cereals 50 g.	cereals 50 g.	cereals 50 g.

The protein content of these structures ranges from 20 to 25 g., or 22 g. on average.

Minerals

VITAPRO products incorporate useful quantities of iron, calcium and magnesium (Tables IV and V). *It is interesting to compare these quantities to the daily recommended intake for the French population.*

Beef-flavoured VITAPRO

==> Iron

The nutritional density is 2.16 mg. per 100 Kcal of food.
25 g. of dehydrated beef-flavoured VITAPRO covers 15% of the recommended intake.
The statement "Contains natural iron" is allowed by regulation.

==> Calcium

The nutritional density is 74 mg. per 100 Kcal of food.
25 g. of dehydrated beef-flavoured VITAPRO covers 9% of the recommended intake.
The statement "Contains natural calcium" is allowed by regulation.

==> Magnesium

The nutritional density is 51 mg. per 100 Kcal of food.
25 g. of dehydrated beef-flavoured VITAPRO covers 17% of the recommended intake.
The statement that beef-flavoured VITAPRO is naturally rich in magnesium is possible.

Chicken-flavoured VITAPRO

==> Iron

The nutritional density is 1.34 mg. per 100 Kcal of food.
25 g. of dehydrated beef-flavoured VITAPRO covers 9% of the recommended intake.
Naturally contains iron.

==> Calcium

The nutritional density is 47 mg. per 100 Kcal of food.
25 g. of dehydrated beef-flavoured VITAPRO covers 6% of the recommended intake.
Naturally contains calcium.

==> Magnesium

The nutritional density is 38 mg. per 100 Kcal of food.
25 g. of dehydrated beef-flavoured VITAPRO covers 13% of the recommended intake.
Naturally contains magnesium.

VITAPRO products can therefore contribute to the improvement of marginal dietary deficiencies found in certain population groups at risk in France (obese persons, the elderly, the poor).

Glucides

The soybean is a protein-rich oilseed, which explains its relative lack of glucides. Beef- or chicken-flavoured VITAPRO has a higher glucide content than soybeans.

	Soybeans	Beef-flavoured VITAPRO	Chicken-flavoured VITAPRO
Glucides	15%	23%	33%

This superiority in glucides is explained by the presence of wheat flour and dehydrated vegetables in VITAPRO products.

This provides a slight enrichment in starch, a glucide complex worthy of consideration.

Fibres

These are for the most part glucides which cannot be assimilated by the body, but whose favourable effects need no further demonstration. The untransformed soybean is rich in fibres.

Beef- and chicken-flavoured VITAPRO still contribute important amounts of fibre: from 12% (beef-flavoured VITAPRO) to 10% (chicken-flavoured VITAPRO).

VITAPRO products can contribute to the enrichment of our diet which is often deficient in fibre.

Lipids

The soybean has a high lipid content, at 20%. Due to the technology of their manufacture, VITAPRO products have undergone a partial elimination of their lipids.

This leads to a very low lipid content: 5% (beef-flavoured VITAPRO) and 7% (chicken-flavoured VITAPRO).

When the suggested servings per meal are considered, the average is 1.5%, i.e. a very small amount, a useful factor in aiming for a low-fat diet.

Energy content

A serving of 25 g. of beef-flavoured VITAPRO contributes 78 Kilocalories, while chicken-flavoured VITAPRO has 82 Kilocalories. These are quite low levels.

It is important to emphasize that in spite of their low energy contribution, the nutritional density (nutrient content per 100 kilocaloriess of food) of VITAPRO products is nonetheless very favourable.

Conclusion

"I wish, said the emperor, that my people always be protected from famine. And God gave him a soybean" (Chinese legend).

The soybean is a food which belongs to the origins and to the future of humanity. It is the food of the future.

It responds point by point to the principal problems of our diet, and within a single food represents health by contributing to dietary balance. However, to be properly integrated into our daily diet, it must be transformed so as to be both easy to digest and usable as is in cooking. VITAPRO is a product which answers this need for easy and agreeable use: in fact it can be used as a meat substitute accompanied by cereals, vegetables and non-meat and dairy animal products.

The restaurant industry will find in VITAPRO a way to meet its goal of satisfying all dietary requirements.

TABLE I: PROTEIN CONTENT OF VARIOUS FOODS

	PROTEINS (%)	MOISTURE (%)
Soybeans	36	7
Beef-flavoured VITAPRO	31	9
Chicken-flavoured VITAPRO	24	9
Wheat	9	37
Rice	7	12
Corn	9	12
Lentils	23	12
Meat	17	65
Fish	17	81
Eggs	13	74
Cow's milk	3.3	88
Yoghurt	4.8	86
Cream cheese	8.5	80
Comté cheese	29	36

TABLE II: AMINOGRAM

	FAO - WHO Reference protein	BEEF-FLAVOURED VITAPRO
Isoleucine	40	38
Leucine	70	70
Lysine	55	57
Methionine + cystine	35	22
Phenylalanine + tyrosine	60	73
Threonine	40	41
Tryptophane	10	12
Valine	50	38

$$\text{Chemical index} = \frac{22 \times 100}{35} = 63\%$$

TABLE III: AMINOGRAM

	FAO - WHO Reference protein	CHICKEN-FLAVOURED VITAPRO
Isoleucine	40	33
Leucine	70	70
Lysine	55	58
Methionine + cystine	35	24
Phenylalanine + tyrosine	60	62
Threonine	40	41
Tryptophane	10	12
Valine	50	49

$$\text{Chemical index} = \frac{24 \times 100}{35} = 68\%$$

TABLE IV: COMPARATIVE MINERAL CONTENTS

Beef VITAPRO	Iron	Calcium	Magnesium
per 100 g.	6.5 mg.	232 mg.	159 mg.
per 100 kilocaloriess	2.16 mg.	74 mg.	51 mg.
per 25 g.	1.69 mg.	58 mg.	40 mg.
Recommended intake	14 mg.	800 mg.	300 mg.

TABLE V: COMPARATIVE MINERAL CONTENTS

Chicken VITAPRO	Iron	Calcium	Magnesium
per 100 g.	4.3 mg.	155 mg.	123 mg.
per 100 kilocaloriess	1.34 mg.	47 mg.	38 mg.
per 25 g.	1.1 mg.	39 mg.	31 mg.
Recommended intake	14 mg.	800 mg.	300 mg.

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CLIENT REF.: CHICKEN-FLAVOURED VITAPRO Lille, September 22 1995

ANALYSES		RESULTS
DRY EXTRACT	%	90.8
TOTAL FAT CONTENT	%MH	6.8
TOTAL PROTEIN	%MH	24.1
MINERALS	%MH	8.3
GLUCIDES BY SUBTRACTION	%MH	42.4
TOTAL FIBRES (AOAC METHOD)	%MH	9.2
CALCIUM)	mg/100g MH	155
IRON)	mg/100g MH	4.3
MAGNESIUM)	mg/100g MH	123
ENERGY VALUE IN KILOCALORIES	Kcal/100g	327
ENERGY VALUE IN KILOJOULES	KJ/100g	1368
AMINOGRAM		
GLUTAMIC ACID	%MH	5.1
ALANINE (HPLC)	%MH	1.2
ARGININE (HPLC)	%MH	1.7
ASPARTIC ACID (HPLC)	%MH	2.1
CYSTINE	%MH	0.4
GLYCINE	%MH	1.0
HISTIDINE	%MH	0.6
ISOLEUCINE	%MH	0.8
LEUCINE	%MH	1.7
LYSINE	%MH	1.4
METHIONINE	%MH	0.2
PHENYLALANINE	%MH	1.1
SERINE	%MH	1.2
THREONINE	%MH	1.0
TRYPTOPHANE	%MH	0.3
TYROSINE	%MH	0.7
VALINE	%MH	1.2

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CLIENT REF.: BEEF-FLAVOURED VITAPRO Lille, September 22 1995

ANALYSES		RESULTS
DRY EXTRACT	%	91.0
TOTAL FAT CONTENT	%MH	4.8
TOTAL PROTEIN	%MH	31.2
MINERALS	%MH	7.3
GLUCIDES BY SUBTRACTION	%MH	35.7
TOTAL FIBRES (AOAC METHOD)	%MH	12.0
CALCIUM)	mg/100g MH	232
IRON)	mg/100g MH	6.5
MAGNESIUM ()	mg/100g MH	159
ENERGY VALUE IN KILOCALORIES	Kcal/100g	311
ENERGY VALUE IN KILOJOULES	KJ/100g	1299
AMINOGRAM		
GLUTAMIC ACID	%MH	6.1
ALANINE (HPLC)	%MH	1.3
ARGININE (HPLC)	%MH	2.0
ASPARTIC ACID (HPLC)	%MH	3.0
CYSTINE	%MH	0.4
GLYCINE	%MH	1.2
HISTIDINE	%MH	0.7
ISOLEUCINE	%MH	1.2
LEUCINE	%MH	2.2
LYSINE	%MH	1.8
METHIONINE	%MH	0.3
PHENYLALANINE	%MH	1.3
SERINE	%MH	1.5
THREONINE	%MH	1.3
TRYPTOPHANE	%MH	0.4
TYROSINE	%MH	1.0
VALINE	%MH	1.2

We certify our translation to be a true copy of the original.

CH KAY
Traductions scientifiques