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Amino acid composition of some Mexican foods

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RY. Knowledge of the amino acid composition of foods is essential to calculate their chemical score, which is used to predict protein quality of foods and diets. Though amino acid composition of many foods is reasonably well established, better knowledge is needed on native foods consumed in different regions and countries. This paper presents the amino acid composition of different presentations of raw and processed foods produced and consumed in Mexico. The amino acid composition was determined using Beckman amino acid analyzers (models 116 and 6300). Tryptophan was determined using the Spies and Chambers method. Of the different foods analyzed, some comments are made on native or basic foods in Mexico: Spirulin, where lysine is the limiting amino acid, with a chemical score of 67%, is a good source of tryptophan (1.16g/16 gN); amaranth contains high levels of sulphur amino acids (4.09 to 5.34 g/16gN), with a protein content of 15 g/100g; and pulque, a Pre-Hispanic beverage that contains high levels of tryptophan (2.58 g/16 gN) and sulphur amino acids (2.72 g/16 gN). Finally, insects are good sources of sulphur amino acids and lysine.
Key words: Amino acid, food composition, Mexican foods.

RESUMEN. Composición de aminoácidos en varios alimentos mexicanos: La composición de aminoácidos es esencial para calcular la calificación química de un alimento, calificación que se utiliza para predecir la calidad de la proteína cuando se ingiere sola o como parte de la dieta. No obstante es necesario determinar la composición de aminoeacidos de los alimentos consumidos diariamente en diferentes regiones y países. El presente artículo muestra la composición de aminoácidos en alimentos crudos y procesados en distintas presentaciones, que se consumen o procesan en México. La composición de aminoácidos de los distintos alimentos se determinó usando analizadores marca Beckman (modelos 116 y 6300). La determinación de triptofano se realizó con el método de Spies and Chambers. De los alimentos analizados, merecen una mención especial los siguientes: alga spirulina es limitante en lisina con una calificación química de 67% pero que es buena fuente de triptofano (1.16 g/16 gN), el amaranto alto en aminoácidos azufrados (4.09 a 5.34 g/16 gN) con un contenido de proteìna de 15 g/100g y el pulque una bebida prehispánica, que tiene un alto contenido en triptofano (2.558 g/16 gN) y aminoácidos azufrados (2.72 g/16 gN). Finalmente, los insectos son una buena fuente de aminoácidos azufrados y lisina.
Palabras clave: Aminoácidos, composición de alimentos, alimentos mexicanos.

INTRODUCTION

Food protein quality, ie the proportion of ingested ?-amino nitrogen that is retained by the body, is a key nutritional issue since it varies widely from one food protein to another, affecting dietary nitrogen requirements and the interpretation of intake data.

Taking protein quality into consideration is particularly important in evaluating new protein sources, in providing nutritional education and dietary counseling to normal individuals under different physiological conditions (athletes, pregnant or lactating women, elderly persons), in designing and regulating low-cost protein mixtures and in the development of products for special needs such as infant formulas, weaning foods, tube feeding, and treating inborn metabolic errors and other specific diseases (1).

The main determinant of food protein quality is its content of essential amino acids. Thus, the quality of a protein can be predicted from its amino acid composition calculating the chemical score and related indexes. The chemical score is the percentage of the most limiting amino acid in comparison to the so called reference amino acid pattern, which – theoretically – is fully utilized by the body. Reference scoring patterns changes as new know-

ledge on amino acid requirements is acquired. Although the FAO/WHO/UNU 1985 pattern is widely used (2), Young has proposed a new amino acid scoring pattern that takes into account results obtained in studies using amino acids labeled with stable isotopes (3).

A wealth of information on food composition has been gathered worldwide over decades of analytical efforts and research. Nonetheless, there is no data available on native foods or on a variety of regular foods consumed in different regions and countries. In Mexico, Cravioto, et al. began analyzing amino acid content in Mexican foods in 1947 (4, 5), but very little has been published subsequently on the subject. The Instituto Nacional de Ciencias Médicas y Nutrición, Salvador Zubirán (INCMNSZ) continued analyzing amino acids contained in different local foods and in 1996, some of this information was published in the Composition of Mexican Food tables (6). This paper includes data resulting from analysis done at the INNSZ during 1980-2002. Since referring individually to more than 180 foods analyzed would not be practical, the discussion and comments presented include only native foods for which no references can be found in literature on the subject and therefore no comparisons could be made.

MATERIALS AND METHODS

Obtaining and preparing samples

The products were obtained from self-service supermarkets in México City and at different stores at Central de Abastos, the largest food market in the city, which distributes foods from different parts of the country Some products were received directly from people interested in obtaining an amino acid profile of their samples. For perishables, we got 1 kg samples and for industrialized foods we got three small packages of each brand selected.

The samples were transported to the laboratory in bags or plastic containers, at room temperature (21±2°C, 50% RH). The samples weighed at least one kilogram and were wrapped as they are regularly sold. Foods that required cleaning were cleaned manually to eliminate foreign bodies and damaged parts and then cut into small pieces, ground and homogenized in a blender (Osterizer). After this process was completed, the sample was ready for determining moisture and nitrogen content and for amino acid analysis. Determinations of moisture and nitrogen content were carried out twice and for amino acids.

Analysis were done in at least two samples; the average is reported.

Analytical procedures

Moisture

One to two grams of the sample were homogenized and dried to a constant weight in a stove (Precision Mod. 28, Precision Scientific Group), at 105°C (7).

Nitrogen

Between 0.5 to 1.0g of the homogenized sample was weighed and digested with concentrated sulphuric acid (H2SO4) for 30 to 60 minutes using a selenium and potassium sulfate tablet as catalyst. After digestion, the balloon flask with the sample was left to cool at room temperature. The sample was diluted with 75 mL of distilled water; 40% sodium hydroxide was added to this solution and released ammonia was received in a 1% solution of boric acid. Ammonium borate was titrated with a 0.1N solution of H2SO4 (7, 8, 9) (Analyzer Procedure with Kjeltec 1035 Sampler System); (Technique described in the handbook Kjeltec Auto 1030 TECATOR).

To determine crude protein content, the nitrogen content obtained was multiplied by the following factors, as appropriate: 6.38 for milk and by-products, 5.95 for rice; 5.71 for soybean; 5.83 for whole wheat or flour; 5.70 for medium extraction flour and meal; 5.83 for barley and oats; 5.30 for sesame (10); 5.85 for amaranth and its by-products and 5.7 for the rest of the products, according to Sosulski (11).

Amino acid

Sample preparation

Defatting. Defatting was done when the ether extract (12) of the sample was greater than 10g/100. Approximately 100g of the sample were weighed and then washed with an 80:20 chloroform-methanol mix, until they reached an ether extract content of 5g/100g or less. The extracted sample was left to stand at room temperature for approximately two hours to eliminate any residues of the solvent mix (Kjeltec Auto Analyzer Tecator, Mod. 1030), (Technique described in the handbook Soxtec TECATOR HT 1043) (7, 18, 13).

Hydrolysis

a) Analysis of acid-stable amino acids

An aliquot part of the sample was weighed into four 250 mL boiling flasks; the amount was such that there would be 25 mg of protein in each flask. 60 mL of 6N hydrochloric acid and some boiling stones were added to two flasks. They were placed in reflux in an oil bath for 24 hours. The flasks were allowed to cool at room temperature.

Oxidizing the sample for sulphur amino acid analysis

Performic acid was prepared adding 1 volume 30 % H2O2 to 9 volumes of 88% formic acid in a glass stoppered Erlenmeyer flask. Then the mixture was allowed to stand at room temperature for 1 hour, swirling occasionally;

then the flask was immersed in an ice bath for 30 minutes. The acid was prepared just before using. The other two flasks received 10 mL of cold performic acid each, not swirling. The flask was stoppered and placed in a cold room at 4°C for 16 hours. After this time had elapsed, the mixture was evaporated in a vacuum rotatory evaporator at 37°C (25 + 5 mmHg) until completely dry. The dry residue was resuspended with 60 mL HCL 6N, placed at 110°C + 5° for 18 hours and allowed to cool at room temperature.

The four hydrolysates were filtered through Whatman filter paper No. 42 into 250 mL boiling flasks. The flasks were rinsed three times with distilled water and filter rinse, evaporated until dry in a vacuum rotatory evaporator at 60°C, and then washed with distilled water until there was no acid odor. The residues were recovered from each flask using 25 mL of Na-S high performance sample dilution buffer, (Beckman reagent) and Whatman paper No. 42 and received in a dry and clean jar (7,14).

An aliquot part of 1 mL was taken from the filtrates and filtered through a 0.22 mm pore size polysulfonate or cellulose membrane; the filtrate was received in a 2 mL Eppendorf tube. A 100 μL aliquot part was taken from the latter and gauged with a Na-S high performance sample dilution buffer for each 1 mL. The analyzer coils were filled with this solution (Operate amino acid analyzer, according to manufacturer's instructions) (15).

Chromatographic analysis

Beckman 116 and 6300 (System Gold 6300, Beckman Coulter de México, S.A. de C.V.) amino acid analyzers were used and programmed according to manufacturer's instructions. Calibration curves were run with three injections of Beckman CD (Column Diagnostic Reagent and Standard) and STD (Amino Acid Standard for Hydrolyzate Analysis) mixtures. Samples were then placed in the corresponding coil, including a reference standard in one out of every five samples. For sulphur amino acids, the calibrating curve was run with a mixture of Beckman CD standards and methionine sulphonates from Sigma. The duration of each analysis was 80 minutes and working conditions were as follows: High performance sodium column (silicagel, 7.5 microns particle size), 12 cm long, a buffer flow of 14 mL/h, ninhydrin flow of 7mL/h; sequential temperatures were 48°C for 11 minutes, 65°C for 34 minutes, and 77°C for 74 minutes (15 - 17). The concentration of each amino acid was calculated using the ratio between the area of the sample and the area of the standards.

Determination of tryptophan

A sample of approximately 300 mg was weighed in two test tubes; 12 mL of 0.4% papaine solution were added to each tube and then incubated at 65°C for 16 hours. The samples were then filtered through No.41 Whatman paper. Filtrates were received in three clean and dry test tubes and 5 mL of a 0.6% paradimethyl-aminobenzaldehyde solution in 12N hydrochloric acid were added to two of the tubes; 5 mL of 12N hydrochloric acid were added to the third tube (blank) and left to stand in the dark for 30 minutes. Next, 5 mL of 96% ethyl alcohol and 4 to 5 drops of a 0.2% sodium nitrate solution were added to the tubes and left to stand in the dark for an additional 30 minutes (18). Absorbance was read at 620 nm using a Beckman DU 780 spectrophotometer. Tryptophan standards of 0.1 to 0.5 micromoles per mL were included to obtain the calibration curves. Values were obtained by interpolation (7, 14).

Chemical score

The chemical score was calculated using scoring patterns suggested by Young (3).

RESULTS AND DISCUSSION

The amino acid composition, the chemical score and the limiting amino acid of 222 Mexican Foods, some of which are native foods, are presented in Tables 1-7; empty spaces mean that there is no value available. Chemical scores were calculated using the scoring pattern for adults suggested by Young and Borgonha (3) because of its solid experimental support. Comments include only some particular items, mainly native foods of nutritional interest, as analytical considerations and literature comparisons are beyond the scope of this report.

Spirulina This microscopic alga belongging to the *Cyanophyceae* family, received much attention of nutritionists three decades ago as a potential protein source. Interestingly, historical documents indicate that spirulina was harvested from the waters of Lake Texcoco and consumed by the Aztecs as a food ingredient recently it has gained reputation as a cholesterol lowering functional food and it is sold in capsules as a food supplement in naturist stores. Spirulina protein is limiting in lysine with a chemical score of 67 but it is a good source of tryptophan (% of scoring value).

Amaranth Interest in amaranth seeds has increased over the last two decades. Plants of this family are native to Mesoamerica and in Pre-Hispanic Mexico they represented the second largest crop only after maize.

Due to the importance of amaranth seeds in native religious practices, after the Spanish Conquest growing these plants was discouraged and even prohibited in the

New Spain by the Spanish domination (1521 to 1810) and its food use was limited to the leaves and to a candy made from popped seeds mixed with honey. Currently, amaranth cultivation and consumption are gaining popularity and, due to its sensorial qualities, its incorporation in a variety of products is expected to grow.

As it may be observed in Table 1, the seeds of the Mexican varieties of amaranth are limiting in lysine and leucine (~65%) but they are good sources of sulphur amino acids and have protein contents of around 15 g/100gN.

Pulque This Pre Hispanic beverage (Table 1) is still widely consumed in rural areas of central Mexico. It is obtained from the alcoholic fermentation of aguamiel, the sweet juice from the stalk of several species of maguey (Agave sp.). Although on a wet basis it provides only 0.3 mg/16mg of nitrogen, the volume consumed by some people may be high and its amino acid content is interesting since its protein is high in tryptophan (2.35 g/16gN) and sulphur amino acids(2.72 g/16gN) although it is limiting in lysine (39%).

Corn. Corn is still the staple food in the Mexican diet as it accounts for 50% of the energy intake and 40% of the protein intake of the average diet. Since Mexico is its site of origin, its importance has never been challenged by any other food either in Pre-Hispanic or modern diets.
The Mexican varieties analyzed provide 8 to 9g of protein per 100g (Table 2); they are limiting in lysine (56%) and poor in tryptophan (63%), but are good source of sulphur amino acids.

Opaque 2 corn is a genetic variety developed by Mertz et al (19) which contains more glutelin and less zein than regular corn and is therefore richer in lysine (2.15 g/16gN in regular corn vs. 3.88 g/16gN in Opaque- 2 corn) and tryptophan (0.70 g/16gN in regular corn vs. 1.14 g/16gN in Opaque- 2 corn) and sulphur amino acids (4.28 g/16gN in regular corn vs. 5.35 g/16gN in Opaque- 2 corn). Chemical scores for regular corn is 55.8% in lysine vs 85% lysine in Opaque-2 corn.

Insects Enthomophagy was, and still is, a common practice in Mexico, especially in rural areas of Central and Southern Mexico, but many restaurants in urban areas offer dishes based on different insects. To date, over one hundred edible species have been registered in the country (20).

Eating insects is not a result of poverty or famine; in Mexico it is a highly appreciated tradition with a significant ritualistic meaning. Furthermore, insects are quite expensive and are considered a delicacy that is frequently offered in fancy restaurant menus. As expected, insects have a high moisture content and provides around 20% of protein. The species analyzed have different amino acid compositions, but as a group they are usually limiting in tryptophan, with chemical scores ranging from 10% (jumiles) to 80% (escamoles). In general, all insects are good sources of sulphur amino acids and, with the exception of jumiles, they are also good sources of lysine.

Common beans *(Phaseolus vulgaris)* are the most highly consumed legume seed in Mexico and, combined with corn, for the last three millennia they have formed the basic complementary cereal-legume system in the Mexican diet. The samples analyzed (Table 5) had a chemical score of around 80% and were limiting in tryptophan and isoleucine (light brown beans) but not in sulphur amino acids (2.50 g/16gN to 5.19 g/16gN) as usually reported; this finding deserves further research.

Although vegetables have high moisture content and provide little protein, their contribution may be relevant because of the amount consumed. Table 7 presents the amino acid composition of some vegetables.

Nopal *(Opuntia sp.)* is a cactus that is widely distributed throughout Mexico and it is used in many traditional dishes. It is extremely popular as a remmedy for diabetes, probably because of its high content of soluble dietary fiber. Its protein content is only 1.4 g/100g but its chemical score is close to 90%, leucine and tryptophan as the limiting amino acids.

The pulp and the pods of mezquite are mainly consumed in rural areas. The pods are particularly interesting because of their protein content of 23 g/100g and their high chemical score (~100%).

Quiote is the flower of maguey. It is a delicacy reserved for special occasions due to its relative scarcity. Its protein content is only ~1g/100g but its amino acid composition is very well balanced, with a chemical score close to 100%.

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TABLE 1
Amino acid content in Mexican foods
Algae, Amaranth and by-products, Beverages
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g produc	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
I. ALGAE													
SPIRULINA *(Spirulina geltleri)*	7.90	57.31	3.56	5.63	3.31	1.65	0.65	3.62	2.53	3.60	1.06	4.16	0.91
II. AMARANTH AND BY-PRODUCTS													
AMARANTH *(A. Leucocarpus)*													
BURST	5.30	15.56	3.07	3.80	3.12	2.35	2.49	2.99	2.55	2.72	0.77	2.99	1.60
FLOUR	3.24	16.39	3.62	5.46	4.35	2.11	1.53	3.64	3.38	2.95	1.44	3.86	2.29
GERMINATED			3.06	2.94	2.85	2.58	2.91	2.93	2.56	2.56	0.87	3.09	1.44
NIXTAMAL-PROCESSED AMARANTH FLOUR			2.76	3.68	3.59	1.72	2.31	2.84	2.54	2.72	0.97	2.71	1.63
ROASTED			3.39	4.20	3.44	2.59	2.75	3.31	2.82	3.00	0.85	3.31	1.77
SEED	8.70	15.29	2.43	3.39	3.83	1.68	1.96	2.71	2.34	2.41	0.73	2.44	1.50
WHOLE FLOUR	8.35	17.42	3.55	5.29	4.96	2.01	2.18	3.53	3.25	2.97	1.32	3.61	2.09
BEER													
BOTTLED	95.53	0.27	3.30	4.25	4.76	1.39	1.39	2.2	1.20	2.52	0.58	3.22	4.16
PULQUE	98.90	0.27	4.04	8.65	1.76	1.12	1.59	6.45	2.76	4.21	2.35	5.12	2.01
NON-ALCOHOLIC BEVERAGES													
MILK BASED													
CHOCOLATE FLAVOR	3.33	12.05	3.80	7.24	5.48	1.93	1.41	4.05	3.41	3.63	1.16	4.72	2.10
POWDER MIXTURE													
PROTEIN 40	7.50	15.14	3.35	9.34	7.22	0.92	1.58	2.05	2.12	4.98	1.66	3.40	0.84
PROTEIN 80 CHOCOLATE FLAVOR	5.25	66.41	4.16	7.94	9.05	2.69	2.09	5.04	4.43	3.67	1.08	5.44	2.14
PROTEIN 80 CHOCOLATE FLAVOR	5.36	61.10	4.2	3.5	4.10	3.05	2.09	3.50	2.97	3.07	1.4	4.45	1.33
PROTEIN 80 COCONUT FLAVOR	3.10	68.28	4.72	9.66	6.08	2.79	2.47	4.92	4.43	3.56	1.03	4.90	2.06
PROTEIN 80 COCONUT FLAVOR	4.80	68.22	4.36	3.90	4.38	3.74	2.01	3.71	3.28	2.79	1.16	4.61	1.45

TABLE 2
Amino acid content in Mexican foods
Cereal seeds
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
IV. CEREALS SEEDS													
BARLEY *(Hordeum distichum)*													
FLOUR	8.20	9.85	3.57	6.94	4.21	1.57	4.12	5.27	3.11	3.20	0.79	4.56	2.25
GRAIN	10.55	9.05	4.17	7.03	3.37	1.51	2.05	5.27	2.39	3.52	1.35	5.30	2.19
CORN *(Zea mays)*													
BLUE	10.60	6.51	2.15	7.30	3.12,			3.03	2.73	2.54	0.69	3.37	2.40
CREOLE FROM CHALCO		9.59	3.34	11.77	2.54	2.37	5.33	4.82	3.87	3.06	0.63	4.14	1.95
ENRICHED NIXTAMAL FLOUR	6.80	9.85	2.05	10.04	3.40	1.56		3.85	2.69	3.07	0.71	2.15	4.09
MEAL, WITH SOY	7.30	9.30	3.48	10.14	4.31	2.38	0.67	4.52	3.17	3.13	1.05	3.86	2.42
NIXTAMAL FLOUR	8.00	7.84	3.16	10.73	3.00	4.24	4.22	3.91	3.11	3.24	0.62	4.22	2.82
NIXTAMAL FLOUR	9.00	8.93	3.48	9.25	3.21	2.08	3.66	3.76	3.13	3.02	0.77	4.38	2.60
NIXTAMAL FLOUR	9.30	8.12	3.07	11.60	2.41	1.48		3.76	3.01	3.02	0.52	3.78	2.52
NIXTAMAL FLOUR	7.70	7.84	3.14	11.76	2.54	1.65		3.89	3.19	3.15	0.57	3.81	2.70
NIXTAMAL FLOUR	11.90	7.97	3.18	11.00	4.38	3.45	2.91	4.06	3.39	2.78	0.57	3.64	2.96
OPAQUE 2		11.01	2.79	7.08	3.88	2.79	2.56	3.70	3.61	2.50	1.14	3.52	3.37
TORTILLA	42.90	8.48	1.81	10.18	2.25	1.47	1.66	4.34	3.62	2.85	1.47	2.95	0.05
WHITE FLOUR	9.30	8.12	0.25	9.48	2.34	1.71	2.30	8.24	2.62	1.53	1.53	3.60	2.10
WHITE FLOUR	10.10	8.03	2.50	9.87	2.15	1.85	2.43	5.98	2.85	2.12	2.12	3.65	2.21
WHITE GRAIN	10.80	8.21	1.97	7.80	2.14			3.28	3.00	2.62	0.61	2.75	1.38
WHITE GRAIN	10.40	9.03	3.06	8.68	2.70			3.76	3.27	3.04	0.59	3.88	2.18
YELLOW CREOLE		8.86	3.86	12.18	2.17	2.33	3.54	4.65	3.47	3.24	0.70	4.72	1.75
YELLOW FLOUR	8.10	7.20	2.65	9.68	2.60	1.92	2.39	7.04	2.84	3.03	2.21	3.74	2.28
YELLOW FLOUR	8.40	7.02	2.71	9.79	2.64	1.95	2.40	7.72	3.00	2.93	1.92	3.91	2.25
MILLET *(Panicum millaceum)*													
GRAIN	11.80	9.67	3.96 •	11.97	1.56	2.16	1.63	5.09	3.37	2.79	1.26	4.96	2.09
OATS *(Avena sativa)*													
FLOUR	6.00	18.18	4.16	7.33	3.79	1.73	3.31	5.15	3.04	3.26	1.62	5.46	2.32
RICE *(Oryza sativa)*													
BREAKFAST CEREAL	2.10	12.60	3.18	7.80	4.07	2.60	0.67	4.19	3.61	2.89	1.18	3.03	4.07
MILLED GRAIN	12.05	7.20	3.34	5.96	3.94	1.48	0.92	4.05	4.04	2.55	1.50	4.23	1.91
RYE *(Secale cereale)*													
RAW	11.00	11.04	3.33	5.45	2.64	1.07	2.09	4.09	1.72	3.05	1.10	4.47	1.92

TABLE 2
Amino acid content in Mexican foods
Cereal seeds
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
IV. CEREALS SEEDS													
SORGHUM *(Sorghum vulgare)*													
DEHULLED GRAIN			3.70	13.48	1.64	1.41	3.27	4.36	3.06	1.44	0.81	4.37	2.02
FLOUR	3.80	18.09	3.83	12.56	1.78	1.61	3.14	4.93	3.88	3.01	0.57	3.49	1.72
GLUTEN		51.25	3.83	13.21	1.50	1.36	1.56	5.18	4.07	2.33	0.36	4.59	1.93
WHOLE GRAIN	10	7.52	3.42	11.47	1.83	1.26	2.54	4.73	3.38	2.93	0.51	4.07	1.44
TRITICALE *(Triticum x Secale triticale)*													
RAW		20.20	4.14	6.72	3.04	1.92	2.78	4.75	2.32	3.14	1.58	5.01	2.48
WHEAT *(Triticum aestivum)*													
COOKIE	7.80	9.18	3.31	6.64	1.24	1.33	4.20	4.75	2.99	2.64	0.74	3.40	2.33
FLOUR	13.47	11.66	3.68	6.70	2.68	1.80	3.73	5.05	3.63	2.95	1.04	4.27	2.16
GRAIN	10.10	9.77	3.01	8.30	2.92	1.17	5.40	3.88	2.58	2.42	1.12	3.85	2.75
GRAIN	7.80	11.60	3.40	7.00	2.00	1.70	5.80	4.91	2.99	2.40	0.60	3.80	2.01
SEMOLINA	13.40	13.62	4.05	6.78	1.93	1.53	3.56	4.54	2.85	2.36	1.75	3.75	1.82
SOUP (PASTA)	0.19	12.22	2.86	7.69	2.04	1.95	3.93	4.60	2.38	2.74	0.80	3.41	2.21
WHITE BREAD LOAF (SLICED)	35.60	8.40	3.47	6.51	1.65	1.62	2.49	4.51	3.29	2.62	1.66	4.26	1.44

TABLE 3
Amino acid composition of Mexican food
Dairy products, Eggs, Fish and Shellfish
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
V. DAIRY PRODUCTS													
CHEESE													
"ASADERO"	46.65	22.85	4.45	7.46	7.59	2.26	0.20	4.33	4.32	3.26	1.52	5.21	2.61
COW MILK	10.55	9.05	4.17	7.03	3.37	1.51	2.05	5.27	2.39	3.52	1.35	5.30	2.19
PASTEURIZED AND HOMOGENIZED (WHOLE FLUID)	90.50	2.74	5.47	10.40	4.25	2.59	2.07	4.90	6.21	4.04	1.91	5.64	0.99
PASTEURIZED AND HOMOGENIZED (WHOLE FLUID)	88.88	2.78	3.81	7.38	6.29	2.16	1.15	8.44	3.61	3.87	6.76	4.69	1.92
POWDERED	3.50	25.40	4.29	8.32	6.54	3.36	0.84	7.11	4.01	3.82	2.23	5.40	2.36
POWDERED SKIMMED	3.11	30.56	4.30	8.60	7.50	2.10		4.20		3.70	1.40	4.80	
ULTRAPASTEURIZED (WHOLE FLUID)	88.55	2.55	3.91	7.63	6.34	2.55	0.86	9.26	4.04	3.61	6.48	4.96	3.41
HUMAN MILK													
AVERAGE	87.10	1.10	5.28	9.20	7.68	2.73	0.94	4.16	5.16	4.72	2.07	5.35	1.73
14 DAYS AFTER CHILDBIRTH (AVERAGE)		1.25	5.28	8.81	7.76	2.91	1.05	4.22	5.15	4.90	1.92	5.21	1.72
56 DAYS AFTER CHILDBIRTH (AVERAGE)		0.99	5.14	8.84	7.46	2.86	0.96	4.17	5.11	4.73	2.04	5.37	1.68
112 DAYS AFTER CHILDBIRTH (AVERAGE)		0.91	5.62	9.68	7.82	2.83	0.97	4.18	4.95	4.59	2.07	5.55	1.75
168 DAYS AFTER CHILDBIRTH (AVERAGE)		0.97	5.28	9.27	7.79	2.60	0.85	4.15	5.05	4.76	2.13	5.08	1.82
252 DAYS AFTER CHILDBIRTH (AVERAGE)		0.99	5.08	9.19	7.48	2.34	0.78	4.14	5.25	4.80	2.10	5.24	1.73
385 DAYS AFTER CHILDBIRTH (AVERAGE)		0.88	5.28	9.43	7.81	2.78	1.04	4.11	5.21	4.50	2.21	5.63	1.76
WHEY													
CONCENTRATED			5.10	11.52	9.17	2.32	5.81	3.50	3.59	4.86	0.89	5.20	2.17
DEMINERALIZATED		14.98	5.09	8.49	7.14	2.94	3.16	2.92	2.58	5.78	2.47	5.08	2.08
YOGHURT	8.10	7.20	2.65	9.68	2.60	1.92	2.39	7.04	2.84	3.03	2.21	3.74	2.28
UNFLAVORED	87.90	3.47	3.38	9.23	10.19	2.15	2.05	4.33	4.55	3.59	2.01	4.87	2.72

TABLE 3
Amino acid composition of Mexican food
Dairy products, Eggs, Fish and Shellfish
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
VI. EGGS													
DUCK *(Anas platyrhinchos)*													
WHOLE, RAW	70.83	11.68	3.47	6.68	8.44	4.50	4.19	5.93	3.83	5.29	0.97	5.20	2.74
HEN *(Gallus gallus)*			3.70	13.48	1.64	1.41	3.27	4.36	3.06	1.44	0.81	4.37	2.02
RAW EGG WHITE, RED	87.30	9.48	4.19	7.08	5.58	2.20	1.92	5.23	3.02	3.71	2.69	5.56	1.90
RAW EGG WHITE, WHITE	86.90	10.12	4.49	7.52	5.96	2.88	2.15	5.22	3.22	3.99	2.46	5.81	2.00
RAW WHOLE RED	75.40	11.13	4.54	7.53	6.27	3.24	2.60	5.49	3.67	4.25	2.23	5.67	2.07
RAW WHOLE WHITE	76.60	11.58	4.55	7.51	6.37	3.28	2.46	5.16	3.74	4.19	2.73	5.65	2.07
RAW YOLK, RED	52.50	13.81	4.58	7.50	6.66	4.98	1.65	3.99	3.87	4.54	2.94	5.16	2.12
RAW YOLK, WHITE	53.00	14.68	4.80	8.01	7.02	1.05	2.32	4.23	3.87	4.69	2.56	5.40	2.32
VII. FISH AND SHELLFISH													
FISH	7.80	9.18	3.31	6.64	1.24	1.33	4.20	4.75	2.99	2.64	0.74	3.40	2.33
ANCHOVY *(Engraulis mordax)*	68.50	15.37	4.24	7.37	9.01	2.64	1.82	3.84	3.29	4.31	0.74	4.70	2.88
FISH (FLOUR)	3.00	82.17	2.50	5.28	2.12	0.47	3.10	2.99	2.95	2.15	0.08	4.43	0.84
GREY MULLET *(Mugil cephalus)*													
RAW	71.60	18.79	4.71	7.45	8.67	2.96	1.59	3.94	3.17	4.01	1.02	4.98	2.80
MOJARRA *(Eugerres spp.)*	72.50	15.96	3.94	6.12	12.16	2.44	1.01	2.41	0.71	3.36	0.24	4.69	1.62
SARDINE *(Sardinopus caerula)*													
PROTEIN CONCENTRATE	5.00	83.27	5.88	8.14	7.83	3.08	0.52	5.23	3.92	3.60	1.23	2.41	2.91
RAW	70.15	16.64	4.48	7.43	5.62	2.43	1.44	3.77	2.76	3.99	0.88	5.50	4.57
SAWFISH *(Scomberomorus maculatus)*	74.10	20.34	2.37	6.34	7.00	3.67	1.40	2.95	3.14	3.74	0.77	3.01	2.20
SHELLFISH													
OYSTER (WHOLE) *(Ostrea sp.)*	91.30	5.47	3.94	6.60	6.72	3.65	1.76	4.82	3.38	4.06	2.10	4.02	1.80
SHRIMP (FLOUR) *(Penaeus setiferus)*	8.40	23.42	4.23	6.24	9.31	1.48	1.90	4.10	3.80	3.49	0.90	4.84	6.32

TABLE 4
Amino acid content in Mexican foods
Insects
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
IX. INSECTS													
ANT *(Atta mexicana)*													
CHICATANA (LARVAE)	74.30	10.85	4.85	7.36	4.43	1.81	1.38	3.80	4.29	3.92	0.59	5.84	2.29
CHICATANA (REPRODUCTIVE ADULT)	50.60	15.50	4.83	7.30	4.47	3.10	1.37	8.03	4.29	3.92	0.55	5.84	2.28
ESCAMOLE *(Liometopum apiculatum)*													
ADULTS (EGG, LARVAE AND PUPAE)	70.80	9.94	4.47	6.93	5.29	2.92	1.28	4.20	9.76	3.83	0.73	5.47	2.64
WORKING (EGG, LARVAE AND PUPAE)	68.40	11.76	3.47	11.22	6.75	6.20	4.47	10.67	6.38	2.46	0.47	2.92	5.29
WORKING (LARVAE AND PUPAE)	70.80	9.94	3.98	8.08	5.47	1.69	2.15	3.17	4.92	3.16	0.57	4.37	3.16
FLY *(Musca domestica)*													
COMMON	80.50	9.67	3.99	7.11	6.62	2.04	2.14	5.41	6.37	4.03	0.53	4.67	2.65
GRASSHOPPER *(Sphenarum purpurascens)*													
ADULT	42.40	30.64	3.37	6.03	4.43	1.24	0.83	2.46	5.27	3.02	0.34	5.38	1.94
ADULT	42.40	30.64	3.83	8.12	5.20	2.28	1.64	9.39	5.75	3.47	0.59	5.20	2.01
NYMPH	42.00	32.83	4.83	7.93	5.20	1.82	1.19	10.67	6.66	3.65	0.55	4.65	1.00
HONEYBEE *(Apis mellifera)*													
LARVAE AND PUPAE	7.26	42.65	3.75	6.02	5.49	1.79	0.87	2.77	3.72	3.12	0.68	4.43	2.10
POXI *(Ephydra hians)*			4.53	7.24	5.25	1.48	2.02	4.52	4.65	4.21	0.38	5.09	0.94
WASP *(Polybia parvulina)*													
BLACK	77.09	12.21	4.24	7.10	6.68	2.14	2.61	3.14	5.37	3.81	0.67	5.59	3.15
CASTILLA HONEYCOMB	72.03	12.73	4.04	7.07	3.27	1.61	1.84	3.59	6.85	3.99	0.60	4.90	3.27
WHITE-WINGED	68.72	19.55	3.82	7.01	5.33	1.79	2.22	3.94	6.46	4.27	0.46	5.23	2.64
YELLOW HORNET	68.03	17.80	4.69	7.72	5.58	1.27	1.44	3.78	5.93	4.05	0.64	5.79	2.54
WORM													
JUMIL *(Euschistus strennus)*	40.15	20.07	3.53	6.97	4.61	3.32	1.91	2.89	5.06	3.52	0.51	5.34	3.05
JUMIL (NYMPH AND ADULT)	7.30	42.59	3.74	7.02	2.83	2.70	0.91	9.30	6.02	3.83	0.09	6.66	1.64
JUMIL (NYMPH AND ADULT)	11.40	33.93	3.56	6.93	4.56	5.40	1.92	7.93	5.11	3.56	0.51	5.38	3.01
MAGUEY RED *(Comadia redtembacheri)*	69.63	8.49	4.65	7.25	4.51	0.84	1.20	3.73	4.87	4.30	0.55	5.58	1.44
MEZQUITE (NYMPH AND ADULT)	57.30	25.44	3.83	6.29	4.10	3.28	2.19	13.13	5.29	3.28	0.53	5.65	6.38
PINK, LARVAE *(Cossus redtenbachi)*	6.20	27.54	4.65	7.20	4.90	1.92	1.19	8.48	4.83	4.29	0.55	5.56	1.46
WATER, LARVAE *(Ephydra hians)*	8.40	5.20	4.56	7.30	5.80	3.47	2.01	9.21	4.65	4.20	0.38	5.11	0.91

TABLE 5
Amino acid content in mexican foods
Legume seeds, Oilseeds and By-products
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
X. LEGUME SEEDS, OILSEEDS AND BY-PRODUCTS													
KIDNEY BEAN (AYOCOTE) *(Phaseolus coccineus)*													
COOKED, DRIED	11.25	18.19	5.35	9.25	6.24	1.15	2.98	6.81	4.04	4.67	0.16	6.20	2.06
RAW	11.92	18.50	4.49	8.04	7.22	1.15	4.02	6.11	3.59	4.86	0.16	5.62	2.49
BEAN *(Phaseolus vulgaris)*													
BLACK, COOKED	65.74	8.86	4.47	7.77	9.50	1.36	1.95	5.50	3.03	4.35	0.96	5.10	3.49
BLACK, GERMINATED DRIED	10.01	27.60	4.24	7.62	10.47	1.71	3.48	5.46	3.28	3.90	0.58	4.65	3.94
COOKED JAMAPA NONFAT FLOUR			4.57	9.00	6.20	1.51	1.37	5.67	3.37	4.02	0.96	5.41	2.41
FLOUR	8.47	19.70	4.78	8.50	9.24	1.20	2.70	6.00	3.67	4.90	0.94	4.99	3.34
JAMAPA NONFAT FLOUR			5.00	9.18	5.65	1.37	1.21	5.60	3.44	3.94	0.82	5.97	1.71
LIGHT BROWN	11.75	23.58	3.31	6.93	9.24	1.24	1.26	5.44	3.36	4.34	1.01	3.75	1.78
BROAD BEAN (FABA BEAN) *(Vicia faba)*													
RAW	8.30	23.07	3.95	8.66	6.44	0.83	1.26	4.16	3.25	3.59	0.74	4.24	2.08
CACAO (Theobroma cacao)													
RAW	3.60	10.94	4.13	8.16	8.65	1.16	1.50	4.66	3.56	2.46	0.36	3.35	2.91
COTTONSEED *(Gossypium herbaceum)*													
SEED	6.12	48.19	2.98	6.15	4.30	1.58	4.46	5.37	3.08	3.67	0.75	3.72	2.11
CHICK PEA *(Cicer arietunum)*													
FLOUR	8.92	15.50	4.13	6.87	6.36	1.19	2.74	5.48	2.88	3.34	0.36	4.28	2.15
GERMINATED AND DRIED	8.90	18.24	3.84	6.73	5.65	1.37	3.59	6.51	3.24	3.33	0.52	4.03	2.23
ROYAL PONCIANA *(Delonix regia)*													
WHOLE FLOUR	8.20	18.50	3.31	6.79	4.24	1.35	3.54	4.31	3.03	2.58	0.63	3.38	1.88
GUANACASTE, EARPODTREE *(Enterolobium cyclocarpum)*													
ROASTED DEHULLED SEED	2.00	31.04	4.23	8.04	5.65	1.61	0.20	4.02	4.09	3.49	0.40	4.32	5.03
SEED, RAW WHOLE FLOUR	6.90	32.08	4.00	7.73	6.95	1.99	0.35	3.60	3.57	3.39	0.92	3.95	6.15
SEED, RAW WHOLE	8.00	17.83	4.43	8.03	6.10	1.61	0.30	3.87	3.53	3.48		4.49	5.09
WHOLE POD	10.90	13.17	4.55	7.24	6.68	1.84	0.41	3.90	3.75	3.75		4.24	4.29
GUAJE *(Leucaena esculenta)*													
SEED, DEHULLED FLOUR	8.70	26.08	4.72	11.68	5.75	1.45	1.91	5.13	3.01	2.60	0.78	5.13	2.52
JOJOBA *(Simmondsia chinensis)*													
PASTE	9.22	20.90	3.46	7.12	4.48	1.07	4.28	4.45	4.49	4.30	1.86	5.20	1.33
RAW (SEED)	4.23	12.26	3.37	7.04	4.74	1.00	4.92	4.33	4.46	5.25	1.98	4.84	1.82

TABLE 5
Amino acid content in mexican foods
Legume seeds, Oilseeds and By-products
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
X. LEGUME SEEDS, OILSEEDS AND BY-PRODUCTS													
LINSEED													
RAW			4.09	5.38	3.37	1.59	1.61	4.09	2.02	3.45	1.78	5.33	2.26
PEANUT *(Arachis hypogaea)*													
TEXTURIZED	8.00	49.34	3.26	6.92	3.35	1.04	2.41	5.33	4.30	2.23	0.80	3.65	2.29
SAFFLOWER *(Carthamus tinctorius)*													
PROTEIN CONCENTRATE			3.37	5.65	2.00	1.32	1.50	4.27	2.75	2.57	1.20	4.95	2.22
SESAME SEED (Sesamun indicum)													
FLOUR, DEHULLED SEED	7.68	44.25	3.89	6.92	2.83	2.63	0.69	4.09	3.95	3.69	1.50	5.01	
NONFAT RESIDUAL MEAL		27.00	5.04	7.38	6.37	3.09	4.80	4.92	3.60	4.17	1.31	4.90	2.30
SQUASH *(Cucurbita pepo)*													
CREOLE NON-ROASTED DEHULLED RAW SEED	5.90	31.46	2.95	5.96	2.99	4.03	2.78	5.54	2.92	2.42	2.83	3.74	1.89
CREOLE RAW SEED	5.78	27.63	3.76	7.23	3.99	5.14	2.81	5.38	3.57	2.57		4.30	1.99
CREOLE ROASTED DEHULLED SEED	1.60	32.19	3.05	6.06	2.98	4.15	2.80	5.35	2.90	2.90	2.17	3.85	1.92
ROUND NON-ROASTED DEHULLED SEED	6.90	31.74	2.81	5.72	2.95	3.78	2.47	5.17	2.83	2.38	2.86	3.55	1.85
ROUND ROASTED DEHULLED SEED	3.60	32.47	2.96	5.80	2.85	3.88	2.44	5.05	2.79	2.36	2.57	3.77	1.84
SOYBEAN *(Glicine max)*													
DEFATTED FLOUR	7.90	43.96	4.74	7.04	6.13	1.29	2.06	4.61	3.04	3.54	1.78	5.33	2.72
GERMINATED (2 DAYS) DRIED	5.70	42.32	3.94	7.60	6.08	1.27	3.20	5.30	3.79	3.44	1.21	4.78	2.40
INSTANT ATOLE	5.20	20.35	6.80	8.90	5.00	2.20	0.96	5.98	5.20	4.22	1.64	5.58	1.78
RAW BEAN, DEHULLED	4.50	38.50	5.00	8.16	6.31	0.99	0.95	4.92	3.60	3.80	1.39	5.27	2.30
RESIDUAL MEAL	6.30	44.10	4.84	8.21	5.08	1.35	4.22	5.27	3.78	3.66	1.30	4.49	2.30
RESIDUAL MEAL	16.20	40.65	4.57	7.82	3.85	1.11	5.11	4.94	3.66	4.12	1.04	4.68	1.67
SOY "MILK"	87.70	2.90	4.09	7.54	6.46	0.47	0.07	6.30	3.52	3.80	7.48	4.86	2.25
TEXTURIZED	6.35	51.75	4.25	7.07	6.61	1.27	0.49	5.36	3.65	3.83	1.58	5.05	2.75
WHOLE FLOUR	2.20	24.50	4.31	7.11	5.93	2.01	0.78	4.75	3.04	3.78	1.17	4.32	2.07
WHOLE GRAIN		45.00	4.78	8.72	6.26	0.58	1.09	4.82	4.46	8.38	1.35	6.04	2.85
SUNFLOWER *(Helianthus annus L.)*													
FLOUR	7.20	39.83	4.03	5.69	3.16	2.01	3.56	4.20	1.73	3.58	1.11	4.82	2.02
PASTE		20.60	3.84	2.84	2.56	2.02	6.68	3.32	1.81	2.89	1.20	4.00	1.40
PROTEIN CONCENTRATE	9.10	51.08	4.06	6.02	2.77	2.23	3.50	4.26	2.44	2.84	1.40	5.79	1.71

TABLE 6
Amino acid content in Mexican foods
Meats and By-products, Miscellaneous, Tubers, Bulbs and Roots
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
XI. MEATS AND BY-PRODUCTS													
POULTRY													
CHICKEN *(Gallus gallus)*													
BREAST,BONELESS WITH SKIN	70.00	17.60	4.20	7.00	7.68	3.47	1.25	3.98	3.14	3.88	1.99	4.50	
FLOUR	3.40	50.12	4.30	7.79	4.32	0.61	2.89	4.04	2.29	3.43	0.24	7.10	
LEG, BONELESS WITH SKIN	70.90	14.41	4.09	7.05	7.73	4.25	1.71	3.92	3.10	3.98	2.02	4.22	
THIGH, BONELESS WITHOUT SKIN	63.00	13.13	4.40	7.41	7.93	3.18	1.09	4.01	3.29	4.04	2.06	4.52	
WHOLE, BONELESS WITH SKIN	64.30	14.41	4.30	7.50	6.88	3.45	1.20	4.21	3.37	4.22	1.80	4.43	
SWINE													
FLOUR	1.90	54.99	3.01	6.38	5.47	5.84	0.46	3.37	2.55	3.10	0.55	13.68	
MEAT WITH CHILE CONDIMENT		54.26	3.83	7.02	7.10	1.73	1.12	2.65	2.67	3.93	0.76	4.07	
BOVINE													
DRIED BLOOD		45.51	1.50	9.98	6.89	1.20	1.38	7.10	1.33	4.30	1.03	6.68	
DRIED BLOOD (AVERAGE)		67.51	3.27	6.27	4.23	1.61	5.41	3.58	2.51	3.22	0.27	4.50	
DRIED LIVER	2.90	49.67	4.54	8.75	5.32	2.42	1.52	4.59	3.26	3.80	0.49	5.67	
DRIED LIVER	4.66	38.39	0.54	8.08	6.17	0.52	0.65	4.51	1.83	3.03	0.65	5.85	
DRIED MUSCLE (AVERAGE)		40.11	2.34	4.89	2.85	0.74	3.50	2.89	1.60	2.67	0.26	4.12	
RUMEN FLOUR		5.02	3.09	6.79	4.28	1.30	1.72	6.73	2.21	3.98	2.38	4.73	
XII. MISCELLANEOUS													
BREWER'S MASILLA	2.75	15.99	2.78	6.27	5.54	2.45	0.35	3.13	9.08	3.67	1.14	5.68	
GRENETINE	7.10	81.90	1.26	2.96	3.45	1.57	0.04	1.93	0.73	1.31	0.02	2.34	
POLLEN	7.50	16.50	4.02	6.70	5.54	1.88	0.57	3.89	2.72	2.78	0.64	5.55	
SODIUM CASEINATE	5.00	86.13	4.56	8.57	6.91	0.48	0.75	4.91	5.23	3.82	0.78	5.22	
XIII TUBERS, BULBS AND ROOTS													
YUCCA													
NONFAT SEED			4.47	6.38	4.92	1.61	1.90	4.36	5.45	3.54	1.10	6.15	
SEED (PROTEIN)	5.30	61.56	5.24	7.64	5.09	2.73	3.19	4.69	3.82	4.28	0.80	6.24	

TABLE 7
Amino acid content in mexican food
Vegetables, Yeast
(g per 16 g of nitrogen)

FOOD	MOISTURE g/100g product	CRUDE PROTEIN g/100g product	ILE	LEU	LYS	MET	CYS	PHE	TYR	THR	TRP	VAL	HIS
XIV. VEGETABLES													
ALFALFA *(Medicago sativa)*													
DRIED		38.25	2.60	7.46	4.41	0.45	2.27	3.21	2.33	2.52	0.21	3.27	2.31
TABLET	7.72	10.31	4.49	8.38	4.98	1.01	2.12	5.18	3.40	5.12	0.60	4.72	1.89
BEET *(Beta vulgaris)*													
RAW	87.88	1.92	2.02	1.23	1.17	0.43	0.68	1.67	1.10	1.17	0.16	1.84	0.69
BROCCOLI *(Brassica oleracea)*													
RAW	85.70	3.92	2.63	4.23	3.94	0.74	1.05	3.10	1.86	2.64	1.03	3.71	1.57
NOPAL CACTUS *(Opuntia sp.)*													
RAW STALK	91.63	1.37	2.82	5.17	4.37	1.10	1.23	4.09	10.97	2.89	0.89	3.97	1.76
QUELITE *(Amaranthus chlorostachys)*													
AMARANTH'S LEAVES	86.00	4.36	3.10	5.58	3.61	1.92	1.60	3.00	2.01	2.70	0.17	3.79	1.49
MEZQUITE *(Prosopis juliflora)*													
PULP			3.41	9.64	4.78	1.23	2.38	3.24	3.28	3.06	1.78	6.47	1.71
WHOLE POD	67.13	22.71	3.25	7.17	4.60	1.23	3.08	3.62	2.95	2.76	1.12	5.34	1.82
QUIOTE *(Agave spp.)*	91.00	0.82	4.42	6.76	5.01	1.05	3.07	4.42	3.11	2.69	1.11	4.86	2.66
XV. YEAST													
BREWER'S *(S. cerevisiae)*	3.30	46.51	4.10	6.20	5.02	1.09		3.47		3.92	1.00	4.56	4.38
YEAST	6.80	35.92	4.61	7.51	7.51	3.58	1.99	4.04	3.47	4.61	1.14	4.61	2.33
YEAST	5.60	33.47	5.43	7.04	3.70	2.24	2.75	4.59	1.21	3.26	0.98	6.53	2.01
YEAST	3.20	45.46	3.66	8.10	8.39	1.46	2.82	3.26	2.75	3.49	0.81	4.63	2.07

Note: If you need information about the others amino acids please contact in e-mail: foods@quetzal.innsz.mx