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SEARCHING FOR RECIPES THAT ARE CAROTENOID RICH AND CHILDREN PALATABLE

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SLIDE 1

Our intention with this presentation is to show that it is possible to fill the daily recommended intakes of vitamin A for children of poor countries through the rational use of very common and available foods. This work is the product of collaborative effort of professionals from several disciplines such as anthropologist, nutritionist, food chemists and biochemists: This slide shows the name of all of them.

I would also like to acknowledge the children of Honduras and Guatemala who participated in the study. The study was supported by a grant from ROCAP/USAID.

DEFICIENCY OF VITAMIN A IN CENTRAL AMERICA

COUNTRY	[RETINOL] < 0.70 μmol/L (< 20 μg/dL)	[RETINOL] < 1.05 μmol/L (< 30 μg/dL)	YEAR
GUATEMALA	21.6	46.1	1988
EL SALVADOR	36.0	58.4	1988
HONDURAS	17.7	54.9	1987
NICARAGUA	31.3	67.1	1993
PANAMA	6.0	30.0	1992
BELIZE	10.0	N.E.	1990

SLIDE 2

Recent nutrition surveys, carried out in the countries of Central America, showed that the deficiency of vitamin A continue to be a public health problem for the countries located to the North of the region.

Low levels of plasma retinol were found in one out of five up to one out of three children below five years old in Guatemala, El Salvador, Honduras and Nicaragua.

INTAKE OF RETINOL FROM FORTIFIED SUGAR

AGE GROUP (months)	SUGAR CONSUMPTION (g)	RECOMMENDATION* (%)
6-11	14.4	41.1
12-23	16.1	40.2*
24-35	25.8	64.5*
36-47	37.7	94.2
48-59	44.0	110.0
> 5 years	30.0	50-75
	120.0	200-300

*Note: Considering a level of 10 μg retinol/g sugar.

SLIDE 3

Trying to solve and to prevent the problem, The Institute of Nutrition of Central America and Panama (INCAP) is promoting the introduction or strengthening of sugar fortification with vitamin A. This intervention has demonstrated to be the most beneficial, and cost-effective for a Central American settling.

The sugar consumption data show that, through this source, most of the population is receiving the daily recommended intake of vitamin A. However, for children younger than three years of age, is still necessary to ensure that the diet supplies at least 50 % of the daily recommended allowance. The same is true for persons of other ages, whose sugar consumption is lower than 40 grams per day, that is less than 4 teaspoons full of sugar.

Therefore, in spite of the sugar fortification program the search and promotion of recipes that are rich in vitamin A, specially for pre-school aged children, is necessary. Furthermore, in the long range the goal is to get enough vitamin A through natural foods.

VITAMIN A CONTRIBUTION OF NATIVE HONDURAN PREPARATIONS

PREPARATION	R.E. (μg/100 g)	Cost (US$/100 g)	Palatability
1. Carrot patties	677.2	0.11	++
2. Radish leaves patties	240.8	0.06	++
3. Fried plantain	220.0	0.05	+++
4. Mustard leaves	203.0	0.05	0
5. Yam puree	153.0	0.03	++
6. Pumpkin puree	124.1	0.04	+++
7. Fried yam	87.9	0.06	+++

SLIDE 4

In Honduras, we investigated the vitamin A contents of several native preparations as well as their acceptability by small children. The preparations were made by local women of rural communities on wood fire. Portions of those preparations were treated for their HPLC analysis.

The data presented on this slide show that the best source of vitamin A were carrot, radish leaves, plantain, sweet potato and pumpkin. The children prefered sweet desserts, and soft preparations of plantain, sweet potato and pumpkin. Same behavior has been reported for children of other part of the world.

An interesting finding was the complete rejection of a dish containing mustard greens, a preparation which was accepted by the mothers.

Other conclusions obtained from this table is that several native foods could replace carrot as a good source of vitamin A, and they offer a similar cost per retinol equivalents provided. Furthermore, these foods have the additional advantages that they do not need to be purchase in the market, because they are produced in the traditional home gardens.

COMPARISON OF VITAMIN A CONTRIBUTION OF FOOD PREPARATIONS AND THE VITAMIN A CONTENT OF THE RAW INGREDIENTS

PREPARATION	PORTION SIZE* (g)	R.E. CONTRIBUTION (μg/portion)	R.E. RAW INGREDIENT (μg/100g)	E/T
1. Fried carrot	89	1002	1177	1.1
2. Fried chard	170	462	292	0.9
3. Carrot with vegetable "meat"	105	295	1177	1.3
4. Pumpkin puree	73	134	382	0.7
5. Stuffed plantain with beans	44	112	58	4.9

SLIDE 5

In Guatemala, we carried out a more detailed study at 40 day-care centers of poor periurban neighbours. In this case, food was prepared by the care takers of the centers, who were women from the same communities. Field workers from INCAP stayed in those centers from 6 in the morning until 6 in the afternoon. During this period, they collected several data, including the weight of the raw ingredients and the final weight of each of the preparations offered to the children, as well as the amount of each preparation eaten by children. Samples of the preparations were stored and analyzed for estimating their vitamin A content.

This table presents the data obtained for the children from 12 to 23 months of age. It includes the average intake of the preparations that provided the highest amount of vitamin A. Logically, the dishes made with carrot were the best sources. However, fried chard was as good as carrot, and like in the case of Honduras, pumpkin and plantain were also good sources providing each one about 25 % of the daily recommended allowance.

As a reference, we include in the fourth column of table the vitamin A content of the main ingredient of each preparation. These values are for the raw stage, and they were taken from The Food Composition Table of Latin America. Logically, food very rich in β-carotene make good contribution to the total Vitamin A intake. However, it is dangerous to make a generalization of this statement, as I will show soon.

The last column of the table is a ratio between the vitamin A contents of the preparations calculated experimentally over the estimation made based on the values obtained in the composition table for the raw ingredients. With the exception of the stuffed plantain, the other preparations gave expected results. Accordingly with our data, both in Guatemala and in Honduras, plantain is an excellent source of vitamin A, that we considered has not received sufficient recognition.

COMPARISON OF VITAMIN A CONTRIBUTION OF FOOD PREPARATIONS AND THE VITAMIN A CONTENT OF THE RAW INGREDIENTS

PREPARATION	PORTION SIZE* (g)	R.E. CONTRIBUTION (μg/portion)	R.E. RAW INGREDIENT (μg/100g)	E/T
6. Yam puree	53	18	605	0.1
7. Spinach with egg	27	15	390	0.2
8. Squash with tomato	87	12	32	0.6
9. Tamalitos of Chipilín	36	10	1022	0.7

* For 12-23 months old children

SLIDE 6

This table is similar to the previous one. It illustrates that a very rich food in vitamin A, according to the reported vitamin A contents in the food composition table does not necessarily contribute with an important fraction of this nutrient in the diet. The reason of this result is either that the ingredient is present in a very low amount in the preparation, such as the case of the tamalitos of chipilin, or the consumption is very low, as it could be the case of spinach. Another reasons are high losses during preparation and the existence of high genetic variability as in the case of sweet potato, squash and tomato.

DAILY CONSUMPTION OF VITAMIN A OF CHILDREN FROM GUATEMALAN DAY-CARE CENTERS
(μg Vit. A)

AGE GROUP (months)	SOURCE		TOTAL	RECOMMENDATION (%)
	ANIMAL	PLANT		
6 - 11	48.8	360.8	409.6	117.0
12 - 23	65.6	524.0	589.6	147.4
24 - 35	43.3	550.9	594.2	148.6
26 - 47	57.0	544.3	601.3	150.3
48 - 59	51.1	608.6	659.7	164.9

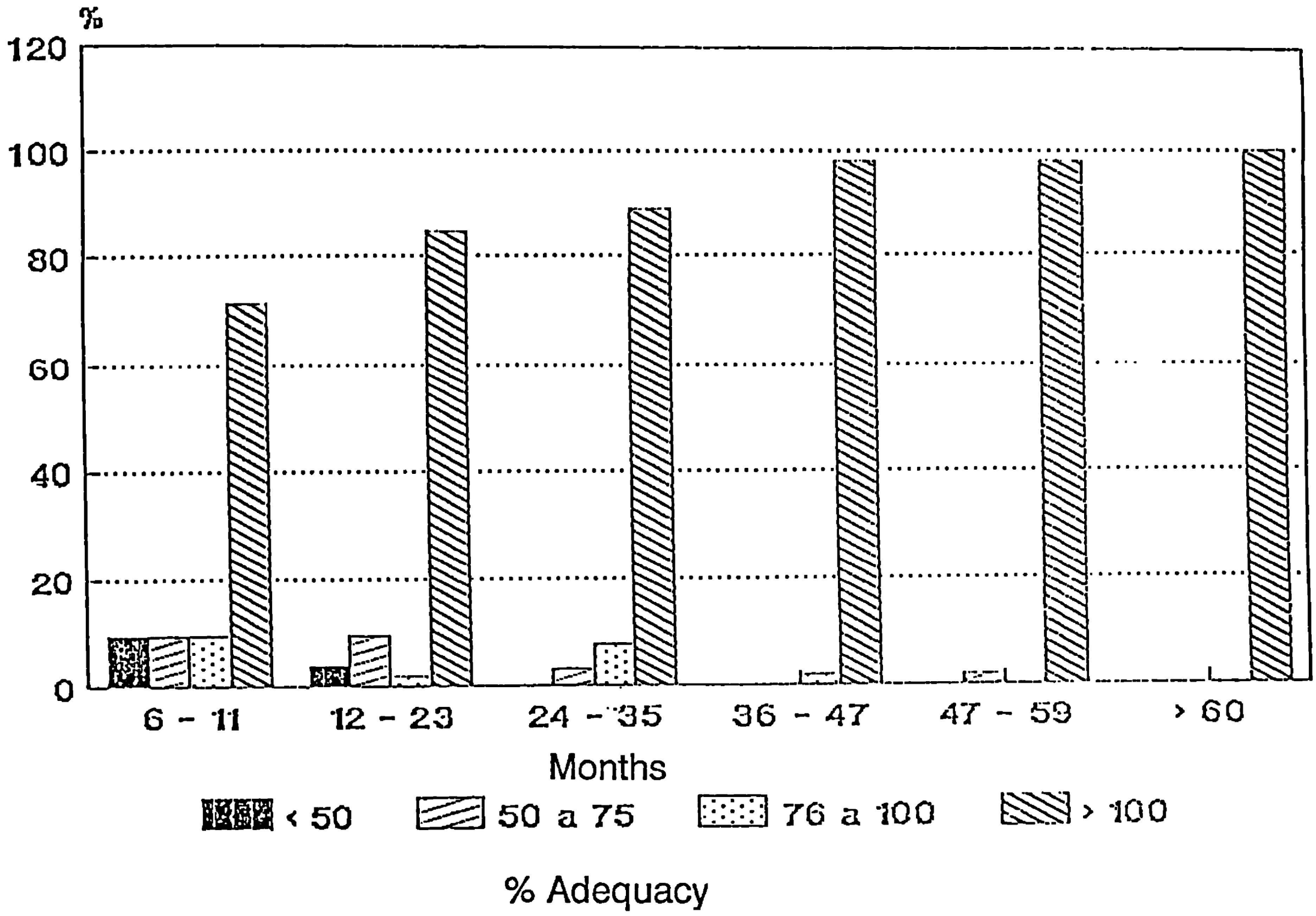
SLIDE 7

This last slide shows the daily vitamin A intake calculated, from experimental data, by age of the children attending the child-care centers of Guatemala City. About 90% of this nutrient comes from plant sources, as it is seen for all the groups. In any case, the diet supplies enough amounts, demonstrating that choosing adequate combinations of non-expensive and simple foods, it is possible to satisfy the daily recommended intakes. In the worst case, it is possible to say that vitamin A deficiency is prevented by the addition of fortified sugar with vitamin A to a diet containing at least one preparation with a medium content of the vitamin A.

In summary:

1. In C.A. countries, it is possible to satisfy the daily allowances of vitamin A by promoting the daily consumption of a few, simple and commonly available food preparations, without the need of introducing new foods and dramatic dietary changes.
2. Recommendation of certain recipes, adequate for vitamin A, should be supported by experimental determination of their true content and the estimation of the amount consumed, considering that genetic diversity, losses during preparation, and child acceptability, could cause over/or in most cases underestimation of vitamina A intake when based only on food composition data of the raw products.

VITAMIN A STATUS OF CHILDREN FROM DAY-CARE CENTERS OF GUATEMALA



VITAMIN A CONTENT OF HONDURAN PREPARATIONS
(R.E. μg/100 g edible product)

PREPARATION	COMPOSITION TABLE	RAW INGREDIENTS	REAL (% RAW)
1. Carrot patties	819.7	508.9	677.2 (133.1)
2. Radish leaves p.	161.4	103.6	240.8 (232.4)
3. Fried plantain	54.9	177.5	220.0 (123.9)
4. Yam puree	348.9	251.4	153.0 (61.0)
5. Pumpkin puree	158.0	233.3	124.1 (53.2)
6. Fried yam	396.4	284.7	87.9 (30.9)

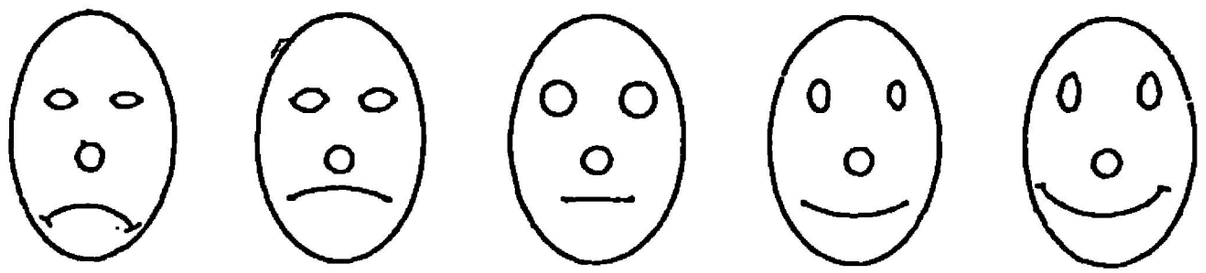
VITAMIN A CONTENT OF ANIMAL FOODS

FOOD	Weight per Unit (g)	ß-Carotene µg/100 g	Retinol µg/100 g	R.E. µg/100 g	R.E. µg/unit
Boiled egg	65	128.7	234.2	255.7	166.2
Scrambled egg	53	130.0	250.3	271.9	144.1
Chicken liver	32	129.1	23671.8	23639.3	7564.6
Beef liver	---	2411.7	16777.6	17179.6	---
Dried fish	---	---	210.4	210.4	---
Fish (patín)	---	---	305.9	305.9	---

FECHA: _____ PANELISTA No._____

MUESTRA No._____

Marque el cuadro con la figura que mejor describe su opinión de la muestra.



Comentarios: _____

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CONTRIBUTION OF GUATEMALAN PREPARATIONS TO VITAMIN A CONSUMPTION

PREPARATION	R.E. (μg/100 g)	INTAKE (μg Vit. A) BY AGE (Months) 6-11	12-23	24-35
1. Cooked vegetables	471	33.0	33.0	76.2
2. Patties of carrot and vegetable-"meat"	281	---	295.0	277.1
3. Fried chard (Beta vulgaris var. cicla)	272	217.6	462.4	263.8
4. Stuffed plantain with beans	254	45.7	111.8	71.1
5. Pumpkin puree	188	---	137.6	144.8

VITAMIN A CONTENT OF GUATEMALAN PREPARATIONS

PREPARATION	MAIN INGREDIENT	(µg/100 g)			R.E.*
		α-carotene	ß-carotene	R.E.	
1. Fried carrot	Daucus carota	1914	5800	1126	1059
2. Cooked vegetables	---	1238	2208	471	213
3. Carrot with "vegetable" meat	Daucus carota	668	1354	281	220
4. Fried chard	Beta vulgaris var. cicla	0	1630	272	287
5. Rice with carrot	Daucus carota	680	1275	269	191
6. Stuffed plantain with beans	Musa paradisiaca	343	1355	254	52
7. Pumpkin puree	Cucurbita maxima	335	960	188	268
8. Beans with spinach	Spinacea oleracea	0	547	91	183
9. Spinach with egg	Spinaceae oleracea	0	333	56	227
10. Salad of broccoli	Brassica oleracea var. botrytis	0	332	55	171
11. Yam puree	Ipomoea batatas	0	196	33	417
12. Tamalito of Chipilín	Crotalaria longirostrata	0	170	28	41
13. Squash with tomato	Cucurbita pepo	0	85	14	22
14. Green beans with egg	Phaseolus vulgaris	20	67	13	27

*From Composition table

VITAMIN A CONTRIBUTION AND CONSUMPTION (g/portion)
OF FOOD PREPARATIONS FOR GROUPS OF AGE

PREPARATION	R.E. CONTENT (µg/100 g)	AGE (Months) 6-11	12-23	24-35	36-47	48-59
1. Fried carrot	1126	---	89	27	15	---
2. Cooked vegetables	471	7	7	28	25	63
3. Carrot with vegetable "meat"	281	---	105	99	127	125
4. Fried chard (Beta vulgaris var. cicla)	272	80	170	97	93	37
5. Rice with carrot	269	---	41	52	101	64
6. Stuffed plantain with beans (Musa paradisiaca)	254	18	44	28	41	58
7. Pumpkin puree	188	---	73	77	73	74
8. Beans with spinach	91	---	66	49	111	74
9. Spinach with egg	56	10	27	31	39	24
10. Salad of broccoli	55	---	---	14	25	65
11. Yam puree	33	---	53	41	---	77
12. Tamalito of Chipilin (Crotalaria longirostrata)	28	8	36	125	117	102
13. Squash with tomato	14	---	87	34	28	82
14. Green beans with egg	13	7	22	50	---	45

VITAMIN A CONTRIBUTION AND CONSUMPTION (µg/portion)
OF FOOD PREPARATIONS FOR GROUPS OF AGE

PREPARATION	R.E. CONTENT (µg/100 g)	AGE (Months) 6-11	12-23	24-35	36-47	48-59
1. Fried carrot	1126	0	1002	304	169	0
2. Cooked vegetables	471	33	33	132	118	297
3. Carrot with vegetable "meat"	281	0	295	278	357	351
4. Fried chard (Beta vulgaris var. cicla)	272	218	462	264	253	101
5. Rice with carrot	269	0	110	140	272	172
6. Stuffed plantain with beans (Musa paradisiaca)	254	46	112	71	104	147
7. Pumpkin puree	188	0	137	145	137	139
8. Beans with spinach	91	0	60	45	101	67
9. Spinach with egg	56	6	15	17	22	13
10. Salad of broccoli	55	0	0	8	14	36
11. Yam puree	33	0	17	14	0	25
12. Tamalito of Chipilin (Crotalaria longirostrata)	28	2	10	35	33	29
			0	0	0	0
13. Squash with tomato	14	0	12	5	4	11
14. Green beans with egg	13	1	3	7	0	6