



Inovação na Fortificação de Alimentos

VIII Workshop em Alimentos

Univates-2007

Lajeado-RS

Agenda

- Funcionalidade - Conceito
- Anemia - Panorama Mundial
- Fontes de Ferro em Alimentos
- Ferrazone[®] - Apresentação
- Conclusões

Alimentos - Fatos

- Valor Presente
 - Redução de custos
 - Distribuição Concentrada
 - Terceirização - Outsourcing
 - Competição Local → Competição Global

Alimentos - Fatos

- China e Índia - Realidades
- Consumidor Informado e Antenado
- Legislação - Entraves

∇ ↓ Qualidade Geral dos Alimentos

∇ ↓ Sensorial

∇ ↓ Segurança

Qual é a saída?

Inovação!

Alimentos - Evolução

- Década de 80
 - Alimentos Vitaminados
- Década de 90
 - Alimentos Light/Diet
- 2000 - Hoje
 - Alimentos Funcionais/Orgânicos

Funcionalidade - Conceito

Desenvolvimento de Alimentos que melhorem a qualidade de vida das pessoas

Alimentos que:

Sejam Seguros

Nutram e forneçam energia

Sejam prazerosos e gostosos

E que ainda trazem:

Biodisponibilidade

Nutricionalmente balanceados

Benéficos à saúde

Ingredientes Funcionais

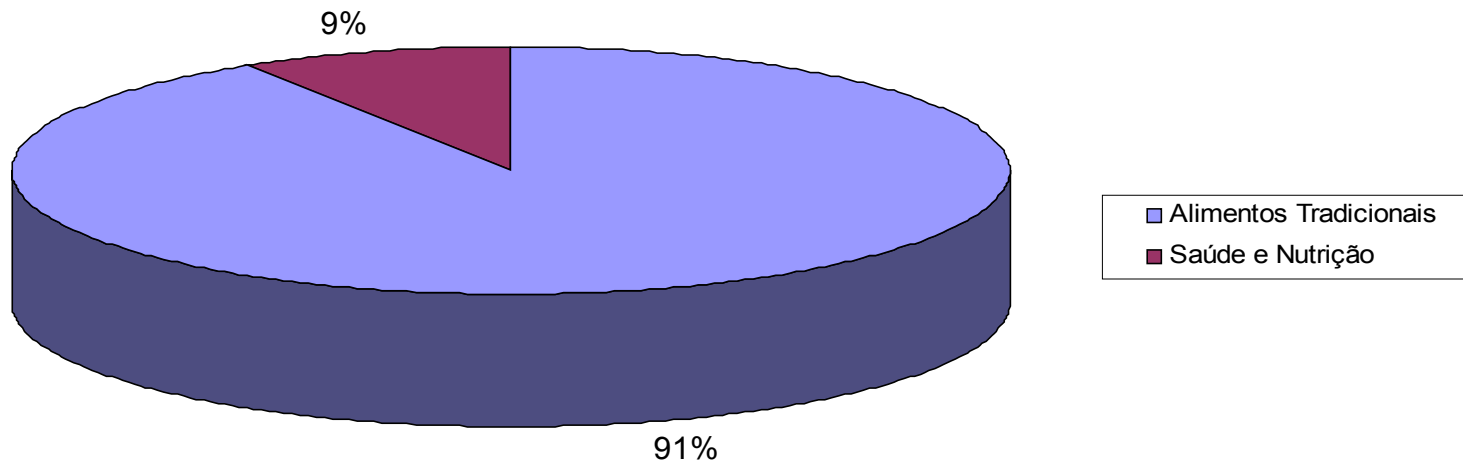
- Euchol CZ-S[®] - Fitosterol solúvel em água
- Ferrazone[®] - Enriquecimento Nutricional
- Soyafibe[®] - Estabilização de Proteínas
- Z-TRIM[®] - ↓ Gordura Trans
- Sta-Lite III[®] - Fibra Solúvel
- Barley Balance[®] - Beta Glucana

Ingredientes Funcionais

- Legislação - ANVISA
 - Estudos de Segurança
 - Estudos Clínicos
 - Registros
- Conflito: Comunicação para o cliente final

Funcionalidade - Mercado

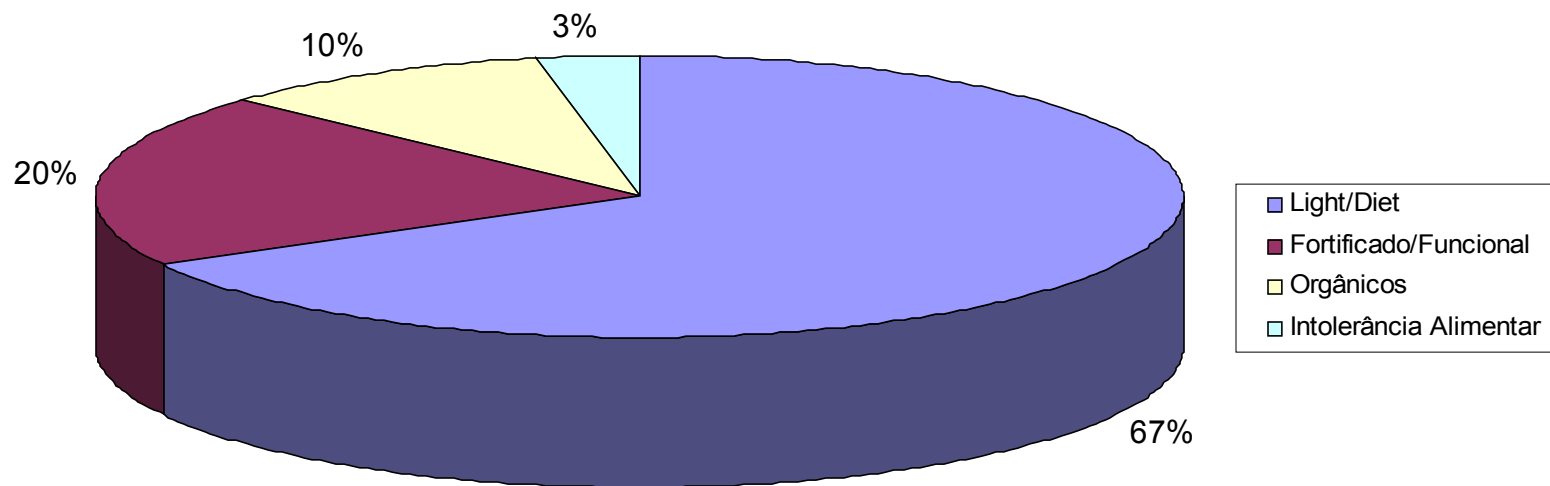
Alimentos - Mundo



Fonte: Euromonitor

Funcionalidade - Mercado

Healthy and Care - Mundo

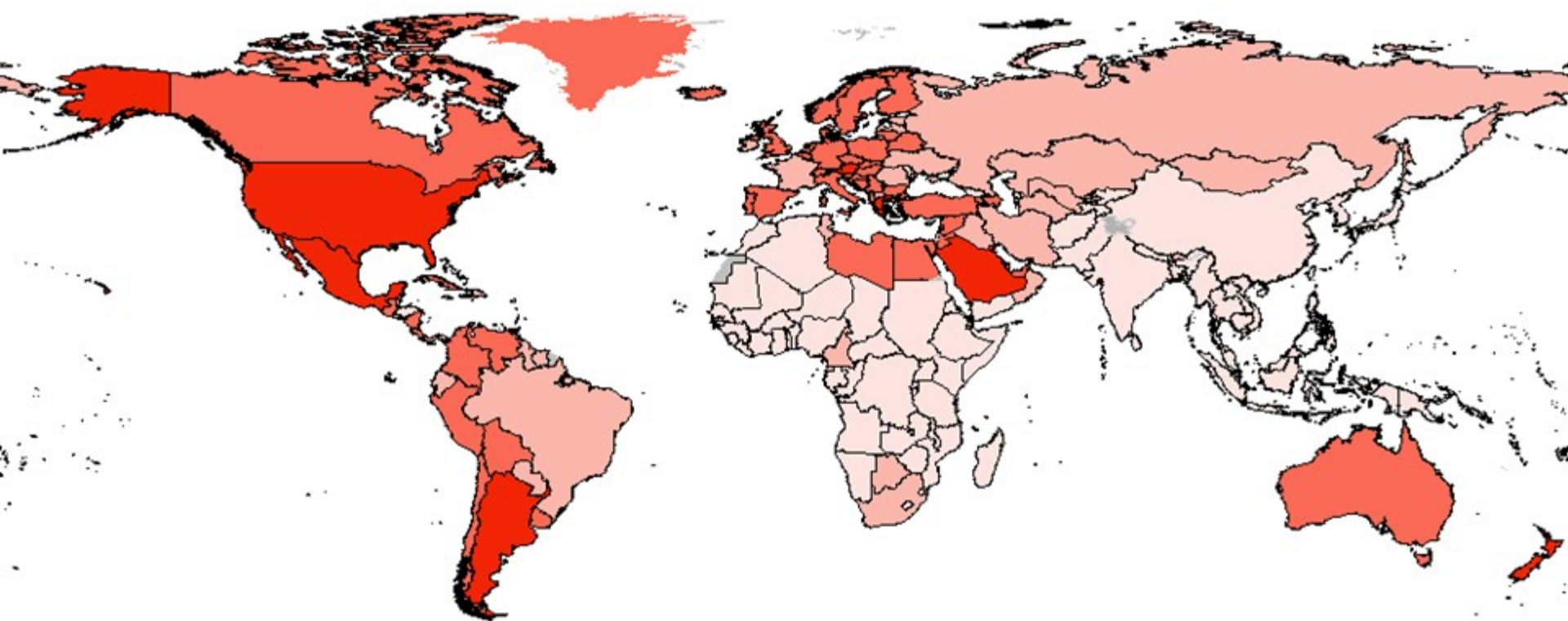


Fonte: Euromonitor

Alimentos - Oportunidades

- ↑ Doenças Crônicas não transmissíveis
 - Obesidade
 - DCV
 - Câncer
 - Diabetes
 - Anemia
- ↑ Longevidade da população

Prevalence of obesity, males, aged 30+, 2005



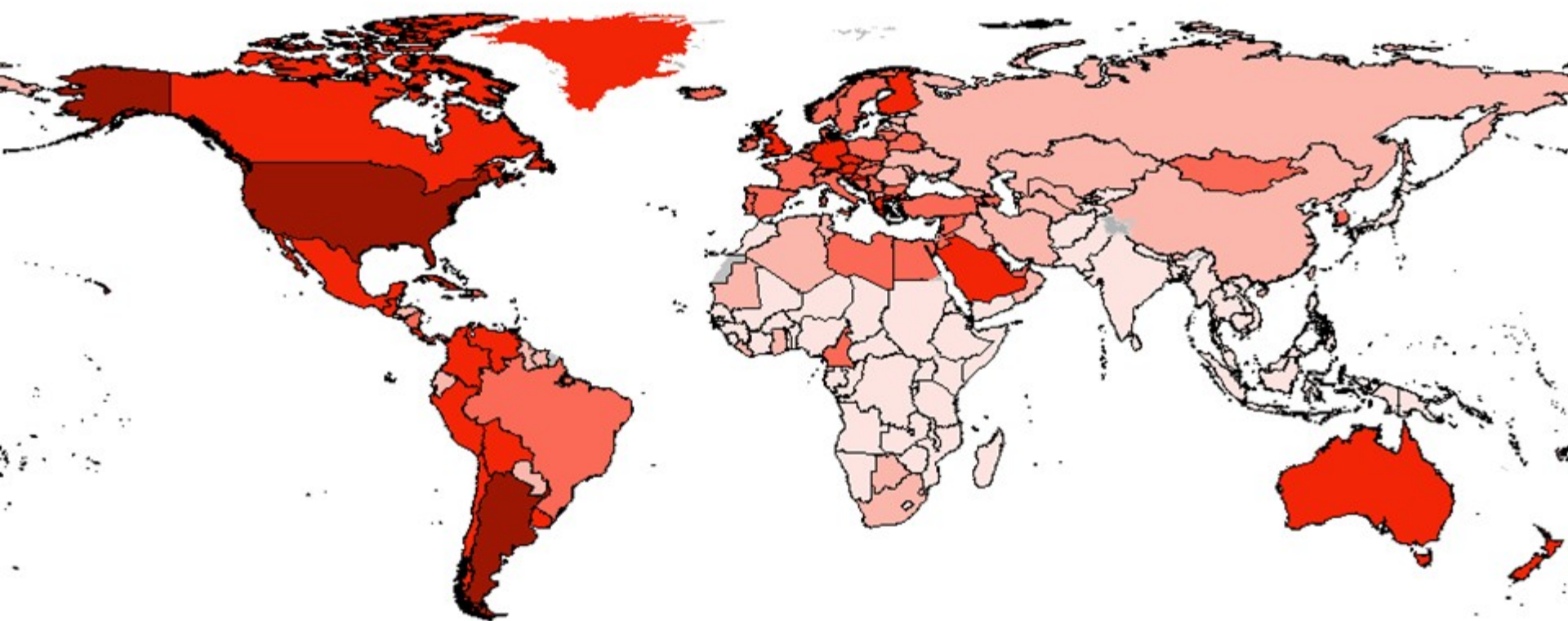
Legend



Estimated % of population with BMI ≥ 30 . Age-standardised to WHO World population.



Prevalence of obesity, males, aged 30+, 2015



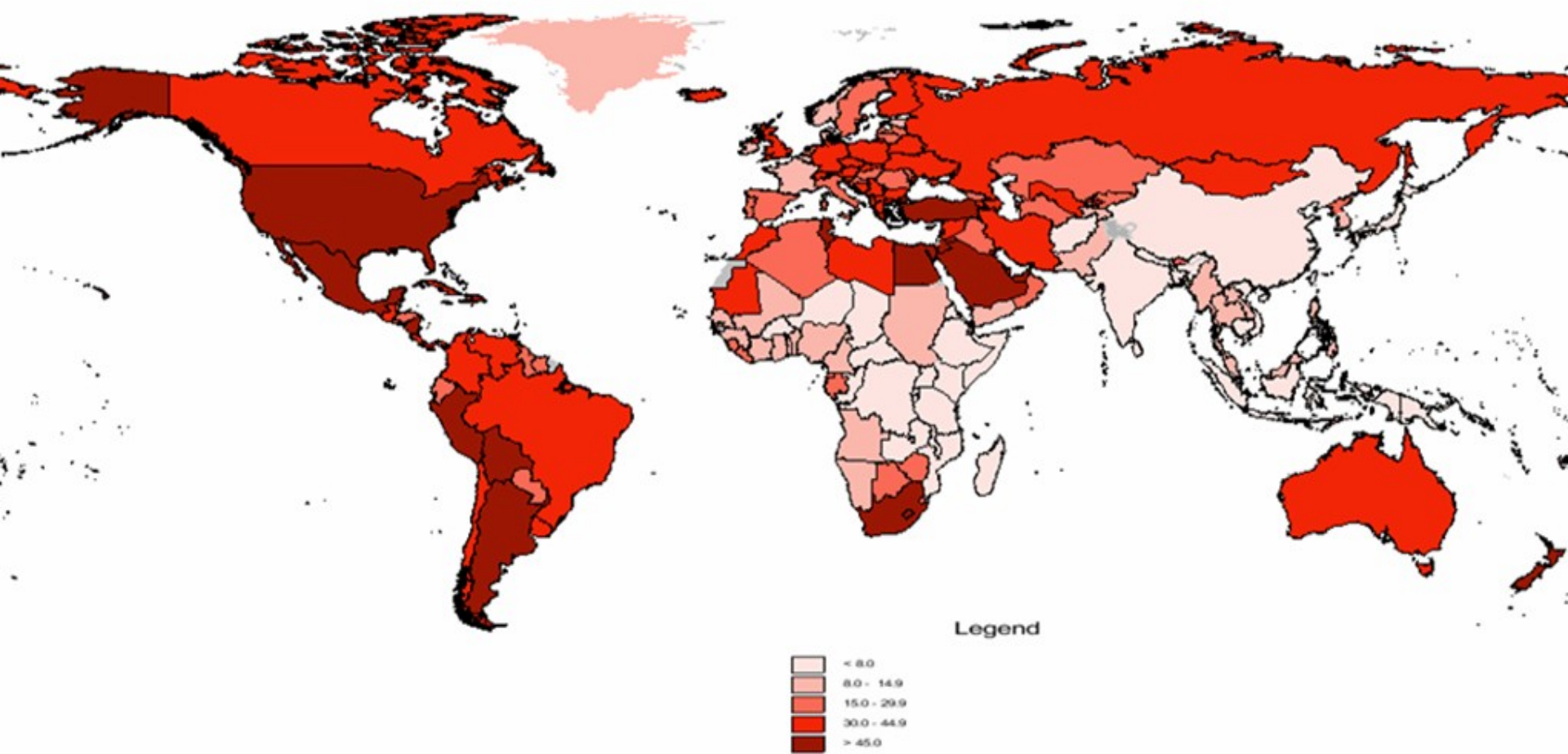
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Estimated % of population with BMI ≥ 30 . Age-standardised to WHO World population.



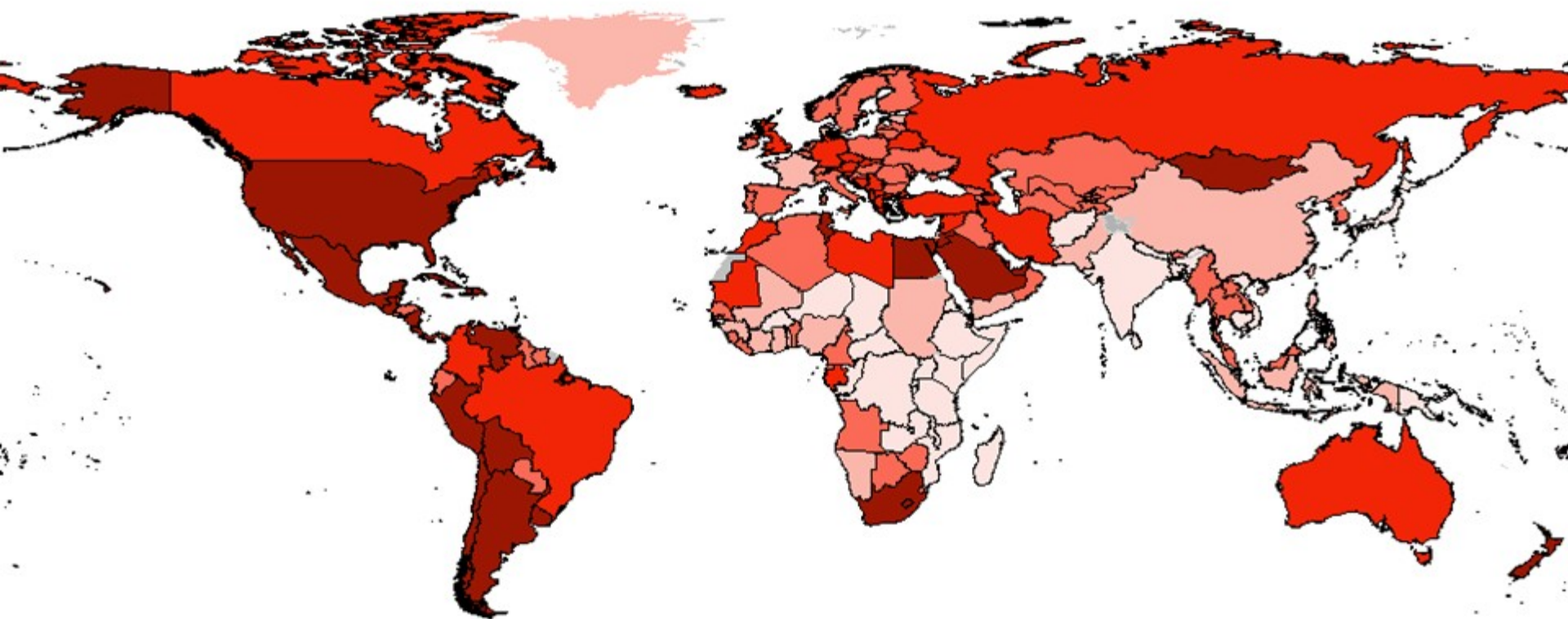
Prevalence of obesity, females, aged 30+, 2005



Estimated % of population with BMI ≥ 30 . Age-standardised to WHO World population.



Prevalence of obesity, females, aged 30+, 2015



Legend



Estimated % of population with BMI ≥ 30 . Age-standardised to WHO World population.



Alimentos - Oportunidades

- ↑ Conscientização Ecológica
 - Preocupação com Resíduos
 - Incorporação de Externalidades
 - Carbono Zero
 - Sustentabilidade
 - Equilíbrio Ambiental

Alimentos - Oportunidades

- ∇ ↑ Stress
- ∇ ↓ Tempo Livre
- ∇ ↑ Vida no Trabalho (Alimentação Fora de Casa)
 - Alimentação desordenada
 - Estilo de Vida
 - Populações-Foco (Casais sem filhos, idosos, solteiros, GLS)

Anemia - Problema Mundial

IRON DEFICIENCY - THE MOST WIDESPREAD HEALTH PROBLEM IN THE MODERN WORLD

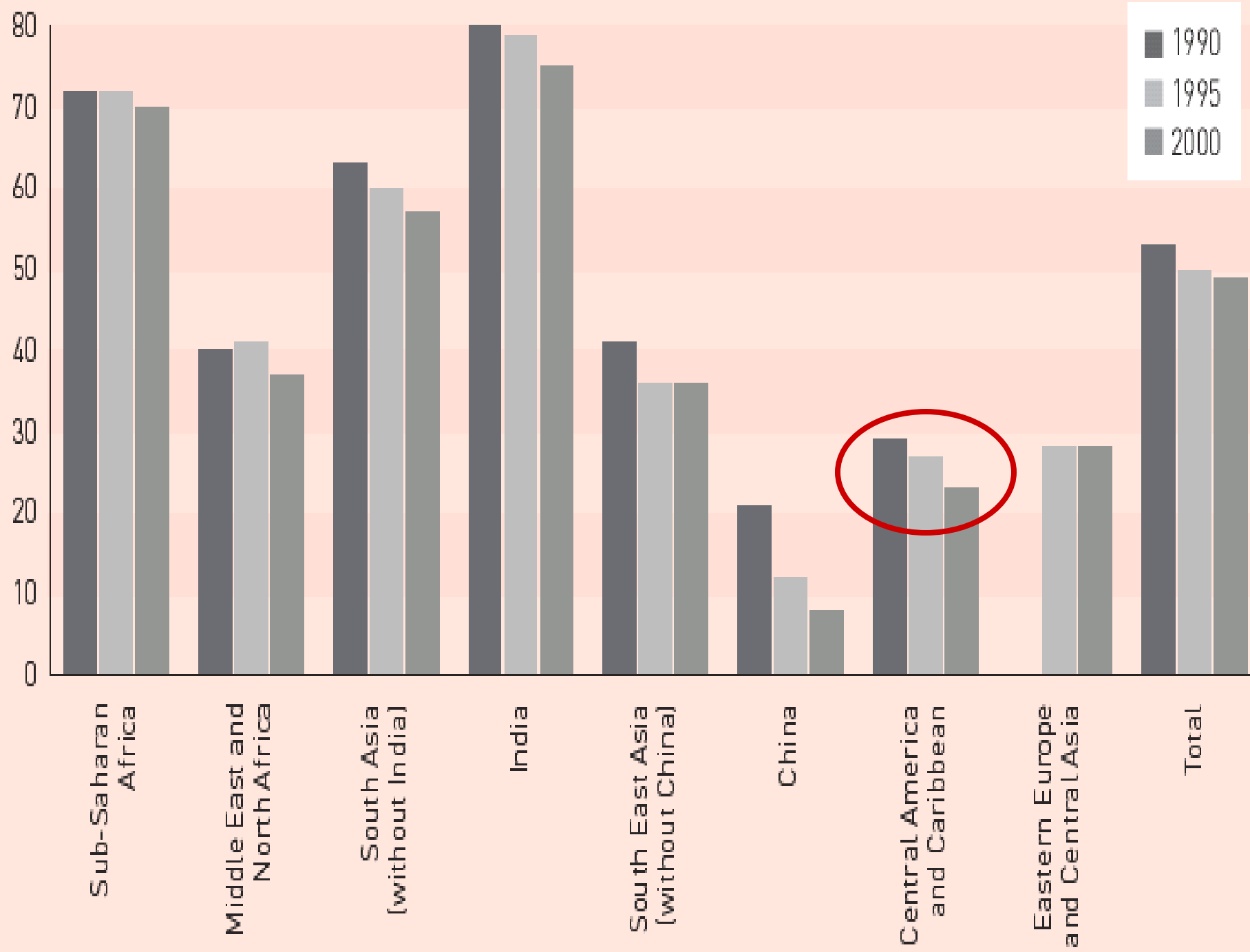
Until the 1990s, iron deficiency was seen as little more than a debilitating nuisance. Now, lack of iron is known to impair the normal mental development of 40% to 60% of the developing world's infants. Iron deficiency also debilitates the health and energies of an estimated 500 million women, and leads to more than 60,000 childbirth deaths a year.



Iron deficiency affects approximately 40% of women in the developing world, undermining health and energy. In childbirth, lack of iron can be tipped into severe anaemia – which kills more than 60,000 young women a year. A three month supply of iron supplements costs about 20 cents. Photograph: Claude Sauageot

UNICEF (2004), Vitamin and Mineral Deficiencies: A Global Progress Report

% of pre-school children estimated to be iron deficient



	Estimated prevalence of iron deficiency anaemia in children under 5 years (%)	Estimated prevalence of iron deficiency anaemia in women age 15-49 (%)	Estimated annual no. of maternal deaths from severe anaemia		Estimated prevalence of iron deficiency anaemia in children under 5 years (%)	Estimated prevalence of iron deficiency anaemia in women age 15-49 (%)	Estimated annual no. of maternal deaths from severe anaemia
Afghanistan	65	61	2,600	Eritrea	75	53	270
Angola	72	59	-	Ethiopia	85	58	4,390
Armenia	24	12	<100	Gabon	43	32	<100
Azerbaijan	33	35	<100	Gambia	75	53	-
Bangladesh	55	36	2,800	Georgia	33	31	<100
Benin	82	65	380	Ghana	65	40	230
Bhutan	81	55	<100	Guatemala	34	20	<100
Bolivia	59	30	120	Guinea	73	43	360
Botswana	37	31	100	Guinea-Bissau	83	53	100
Brazil	45	21	880	Haiti	66	54	310
Burkina Faso	83	48	490	Honduras	34	31	<100
Burundi	82	60	-	India	75	51	22,000
Cambodia	63	58	520	Indonesia	48	26	2,350
Cameroon	58	32	360	Iran	32	29	<100
Central African Rep.	74	49	250	Kazakhstan	49	36	<100
Chad	76	56	550	Kenya	60	43	930
China	8	21	820	Kyrgyzstan	42	31	<100
Congo	55	48	-	Lao PDR	54	48	200
Congo, Dem. Rep.	58	54	4,750	Lebanon	21	24	<100
Dominican Rep.	25	31	<100	Lesotho	51	43	-
Egypt	31	28	230	Liberia	69	44	170
El Salvador	28	34	<100	Madagascar	73	42	520

UNICEF (2004), Vitamin and Mineral Deficiencies: A Global Progress Report

FOLATE DEFICIENCY	ECONOMIC IMPACT	FLOUR FORTIFICATION			SALT IODISATION	VITAMIN A SUPPLEMENTS	
Estimated annual no. of neural tube birth defects	Estimated % of GDP lost to all forms of VM deficiency	Type of programme M = Mandatory, V = Voluntary, P = proposed	IRON (parts per million)	FOLIC ACID (parts per million)	Estimated % of household salt iodised	Estimated % of children receiving at least one dose of vitamin A per year	
2,250	2.3	-	-	-	15	84	Afghanistan
1,400	2.1	-	-	-	35	75	Angola
<100	0.3	-	-	-	83	-	Armenia
225	0.7	V	55	2	26	-	Azerbaijan
8,400	0.9	P	66	1.5	70	90	Bangladesh
550	1.1	-	-	-	72	95	Benin
150	1.6	-	-	-	95	-	Bhutan
380	0.5	M	60	2	85	44	Bolivia
100	0.6	-	-	-	67	85	Botswana
5,250	-	P, M	42	2	87	-	Brazil
1,230	2.0	-	-	-	22	97	Burkina Faso
600	2.5	-	-	-	96	95	Burundi
950	1.4	-	-	-	14	57	Cambodia
1,100	0.8	-	-	-	84	99	Cameroon
300	-	-	-	-	86	90	Central African Rep.
800	1.2	-	-	-	58	91	Chad
38,000	0.2	-	-	-	93	-	China
300	1.9	-	-	-	-	100	Congo

Estudo - Programas de Fortificação

- “O uso da farinha de trigo fortificada com ferro, com o intuito para redução da anemia no Sri Lanka, concluiu que a fortificação com ferro elementar **não foi benéfico** na solução do problema desta população. Isto se deve possivelmente à baixa biodisponibilidade das fontes de ferro utilizadas.”

P. Nestel, R. Nalubola, R. Sivakaneshan, A. R. Wickramasinghe, S. Atukorala, T. Wickramanayake, VITAMIN AND NUTRITION RESEARCH 1/2004 Erscheinungsdatum 2004-01 (c) 2004

Anemia Ferropriva - Conseqüências

- Falta de concentração
- Baixo rendimento escolar
- Fadiga
- ∇ ↓ Desenvolvimento Intelectual
- ∇ ↑ Custo c/ tratamento
- Morte

Fontes de Ferro - Problemas

- Instabilidade
- Reatividade
- Residual Metálico
- Perda de nutrientes no alimento
- Problemas de shelf life
- Aceitação no mercado

Fontes de Ferro - Exigência Básica

BIODISPONIBILIDADE

Fontes de Ferro - Tipos

Water soluble	Fe%	RBV in Rat	RBV in Man
Ferrous sulphate.7H ₂ O	20	100	100
Dried ferrous sulfate	33	100	100
Ferrous gluconate	12	97	89
Ferrous lactate	19	---	106
Ferric ammonium citrate	18	107	---
Ferrous ammonium sulfate	14	99	---
Ferric choline citrate	14	102	---

Soluble in dilute acid	Fe%	RBV in Rat	RBV in Man
Ferrous fumarate	33	95	100
Ferrous succinate	35	119	92
Ferrous saccharate	10	92	74
Ferric glycerophosphate	15	93	---
Ferrous citrate	24	76	74
Ferrous tartrate	22	77	62
Ferric citrate	17	73	31

Water Insoluble	Fe%	RBV in Rat	RBV in Man
Ferric pyrophosphate	25	45~58	21~75
Ferric orthophosphate	28	6~46	25~32
Sodium iron pyrophosphate	15	14	15
Elemental iron:			
Electrolytic iron	98	44~48	5~100
Carbonyl iron	98	39~66	5~20
Reduced	97	24~54	13~148

^{*)} R. Hurrell. 1999. Mineral Fortification of Foods

Fontes de Ferro - Pontos de Interesse

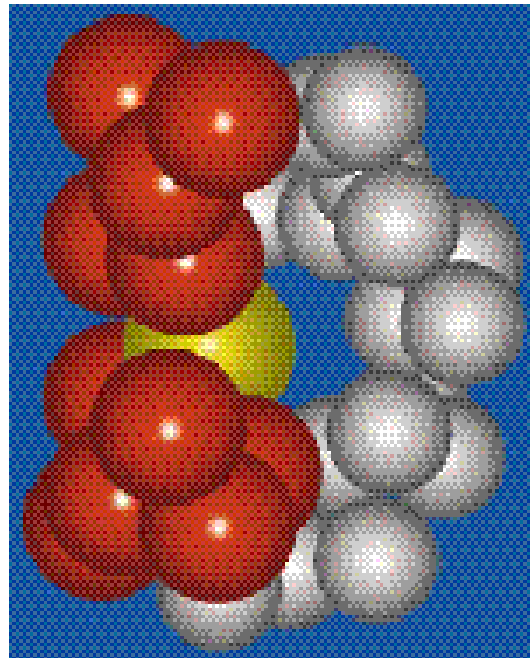
- Alta biodisponibilidade
- Sem residual metálico
- Solúvel em água
- Não reativo
- Estável sob condições de processo
- Seguro ao consumo

Ferrazone[®] - Características

- Totalmente solúvel em água
- Sem residual metálico
- Estável em pH ácido
- Não reativo
- Seguro (GRAS)
- Alta Biodisponibilidade

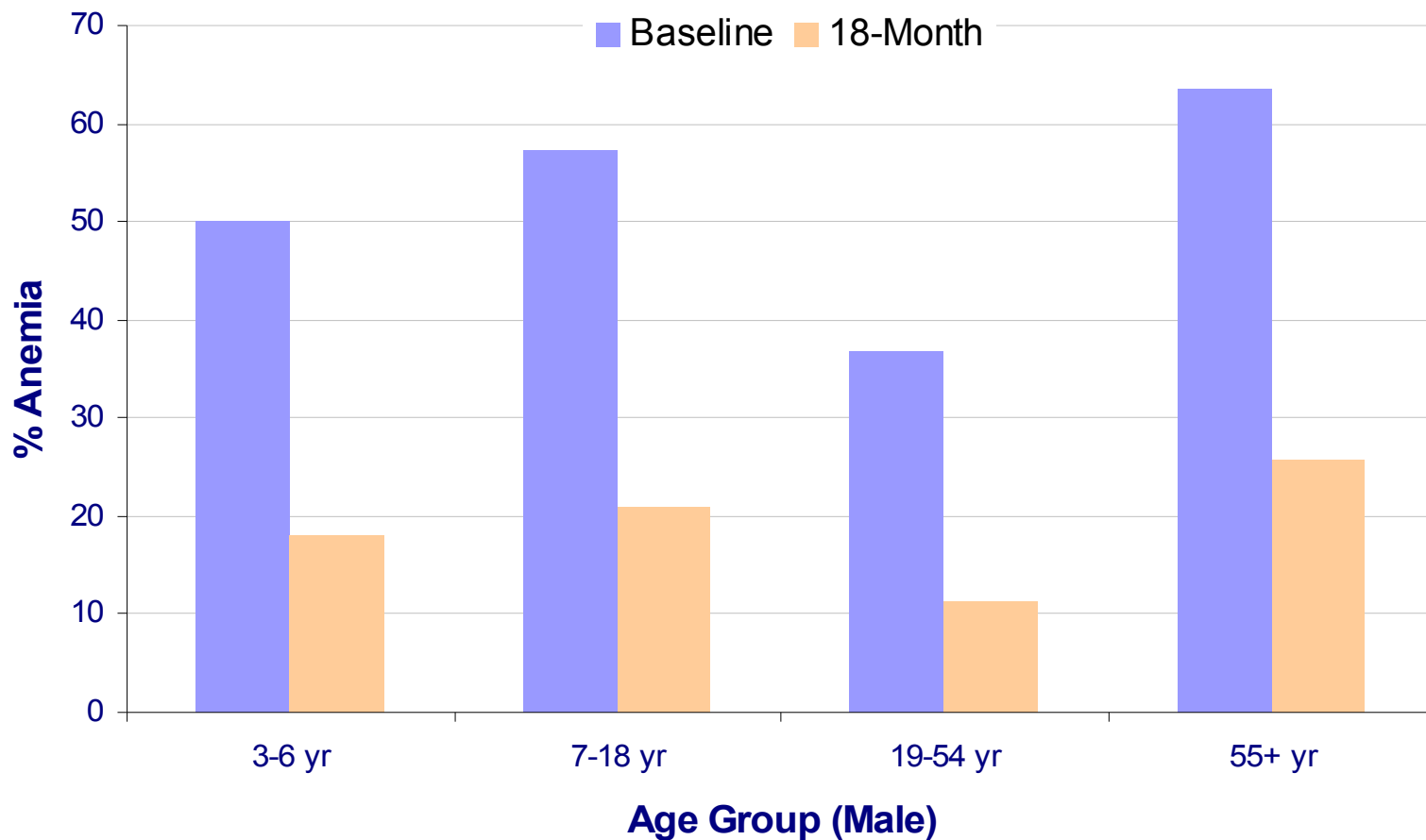
Ferrazone[®] – A ciência

- Processo: Ferro quelato ao EDTA
- $[\text{FeNaEDTA}] \rightarrow [\text{Fe-EDTA}]^- + [\text{Na}]^+$

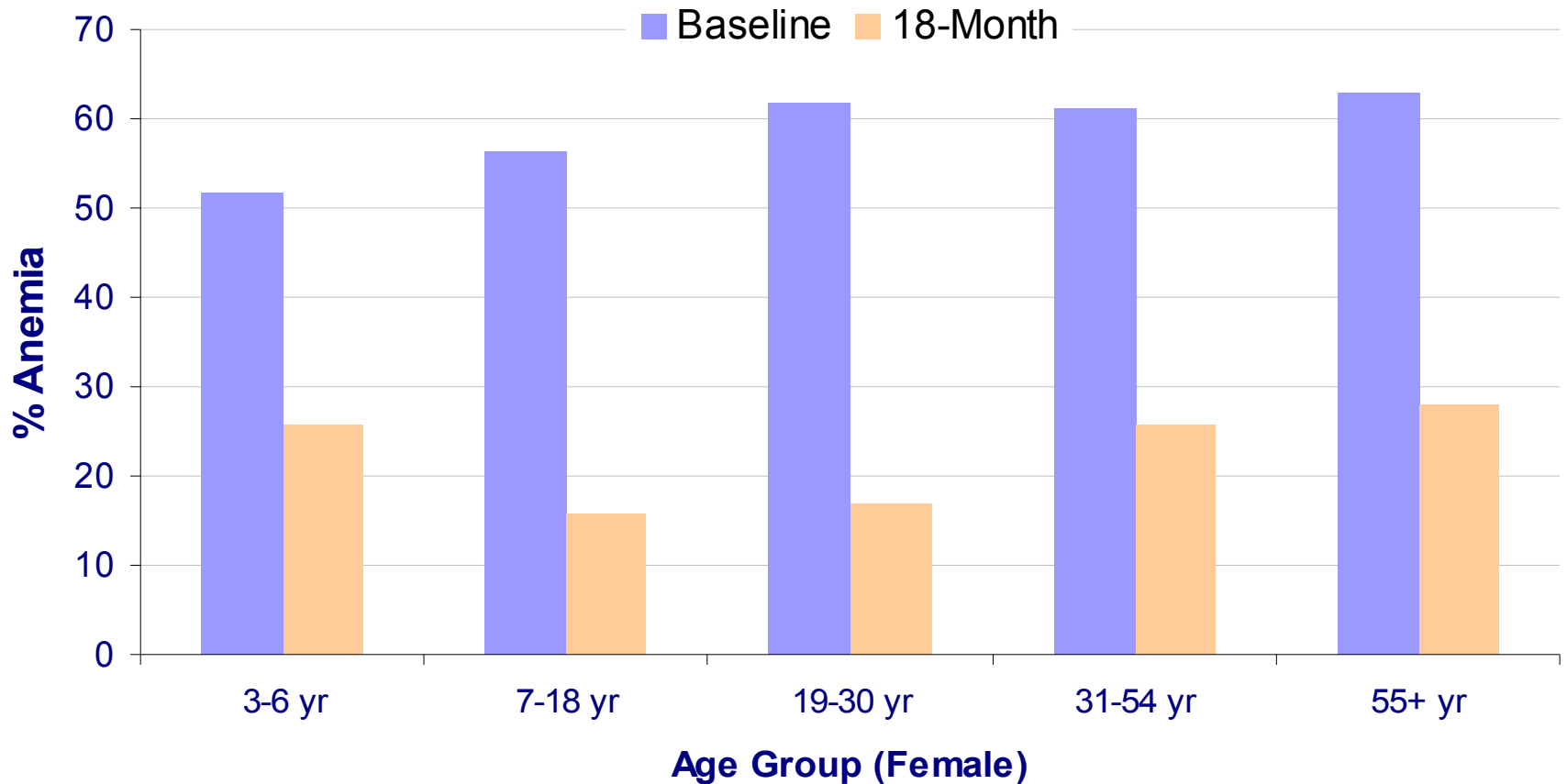


Ferrazone® - Biodisponibilidade

- Estudo na China, 18 meses de duração, com 14.000 pessoas.
- Conclusão: Enriquecimento de molho de soja c/ Ferrazone foi efetivo, na redução e eliminação da anemia nesta população controle.
- Junshi Chen, Xianfeng Zhao et. Al. Food and Nutrition Bulletin, Vol. 26, no. 2. 2005



Chen, J. *et al.* (2005), “Studies on the effectiveness of NaFeEDTA-fortified soy sauce in controlling iron deficiency: A population-based intervention trial.” Food and Nutrition Bulletin, Vol. 26, No. 2, p 177-186.



Chen, J. *et al.* (2005), "Studies on the effectiveness of NaFeEDTA-fortified soy sauce in controlling iron deficiency: A population-based intervention trial." *Food and Nutrition Bulletin*, Vol. 26, No. 2, p 177-186.

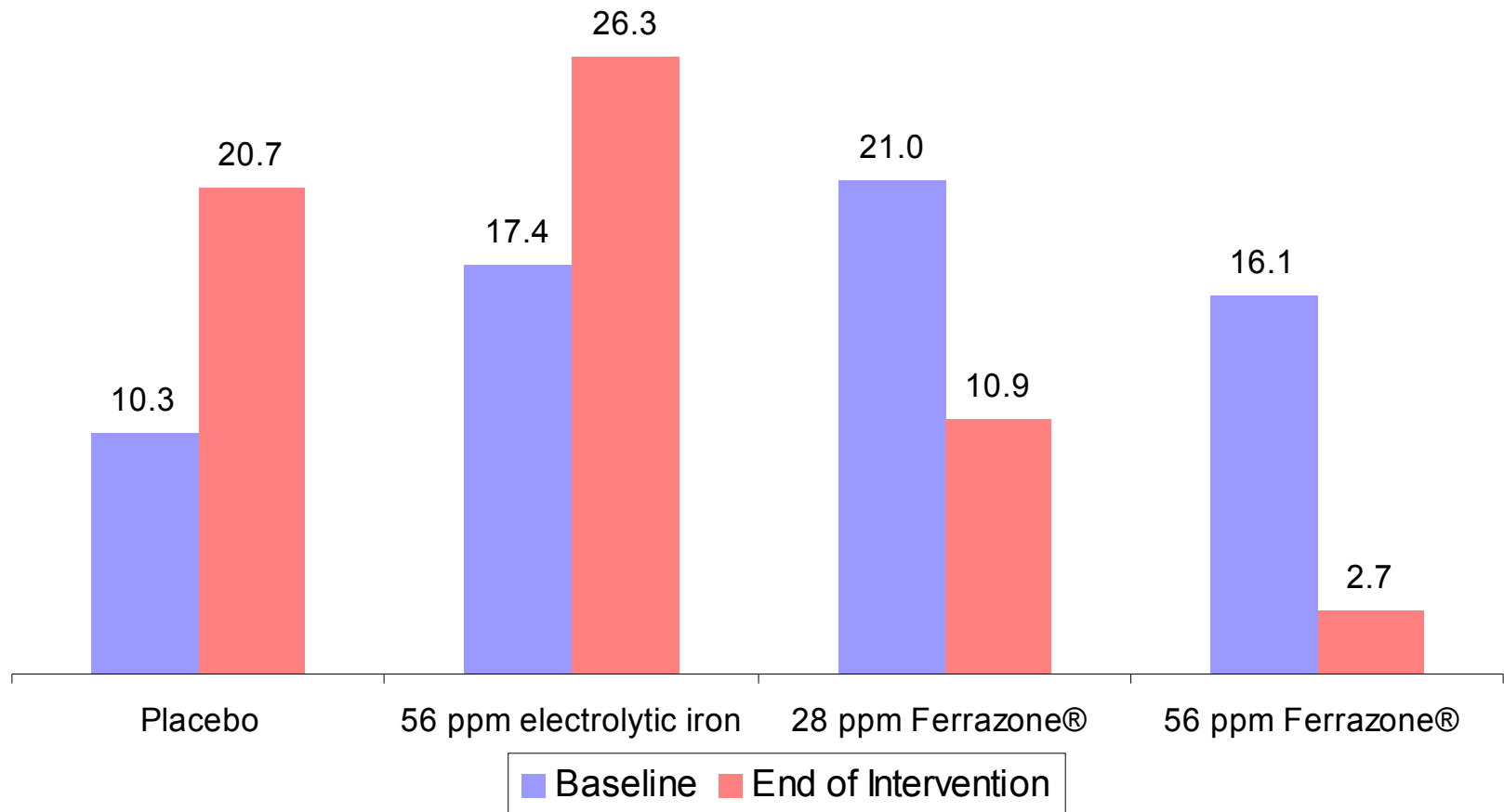
Ferrazone[®] - Biodisponibilidade

Meal Components	Standardized iron absorption (%) ^a			Reference
	Ferrous sulphate	FeNaEDTA	Ratio	
Rice Milk	1.7	4.5	2.6	Viteri et al., 1978
Beans, maize	2.0	5.3	2.7	Viteri et al., 1978
Egyptian flat bread ^b	2.1	5.3	2.5	el Guindi et al., 1988
Bran	2.7	7.8	2.9	MacPhail et al., 1981
Beans, plantain, rice, maize and soy ^c	3.1	7.0	2.3	Layrisse and Martinez-Torres, 1977
Rice	3.9	11.5	2.9	A.P. MacPhail, unpub. 1992
Maize meal	4.0	8.2	2.1	MacPhail et al., 1981
Beans, plantain, rice, maize, soy and meat	4.3	9.6	2.2	Layrisse and Martinez-Torres, 1977
Wheat	6.2	14.6	2.3	Martinez-Torres, et al., 1979
Soy sauce	4.7	10.5	2.2	Huo et al., 2001

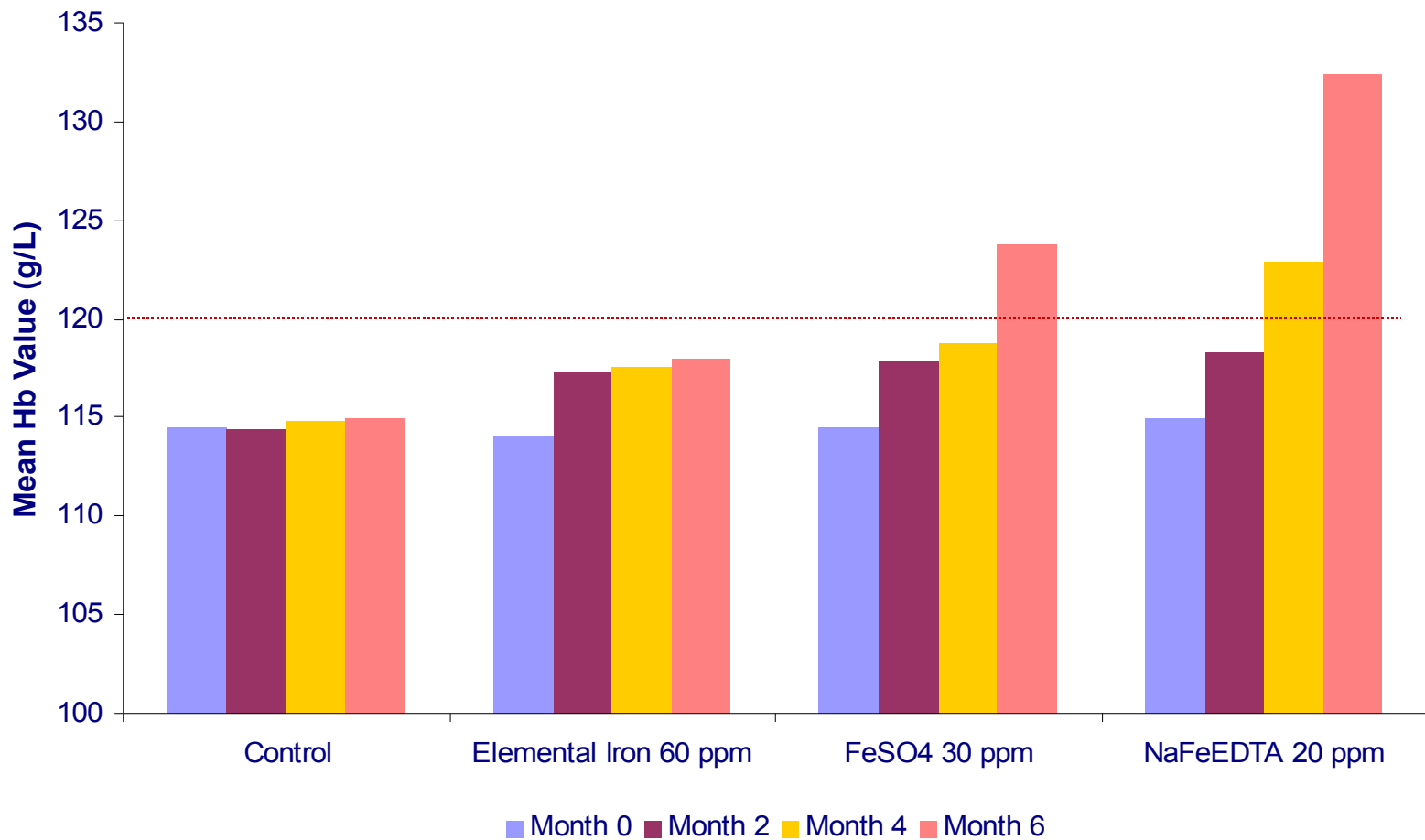
^aGeometric means standardized to a reference absorption of 40%.

^bA mixture of ferrous sulphate and Na₂EDTA was used in this study.

Iron deficiency (%)



Andang'o, P.A. *et al.* (2005), "Effect of whole-maize flour fortified with NaFeEDTA (Ferrazone®) on iron status of school-aged children in Kenya." IUNS Poster, Durban.



Chen, C. *et al.* (2005). “Effects of Wheat Flour fortified with Different Iron Fortificants in Iron Deficiency Anemic Students”, IUNS Poster, Durban.



Loong MN and Goo HK (2004): Iron Fortification of Beverages. School of Chemical and Life Sciences, Singapore Polytechnic. Unpublished.

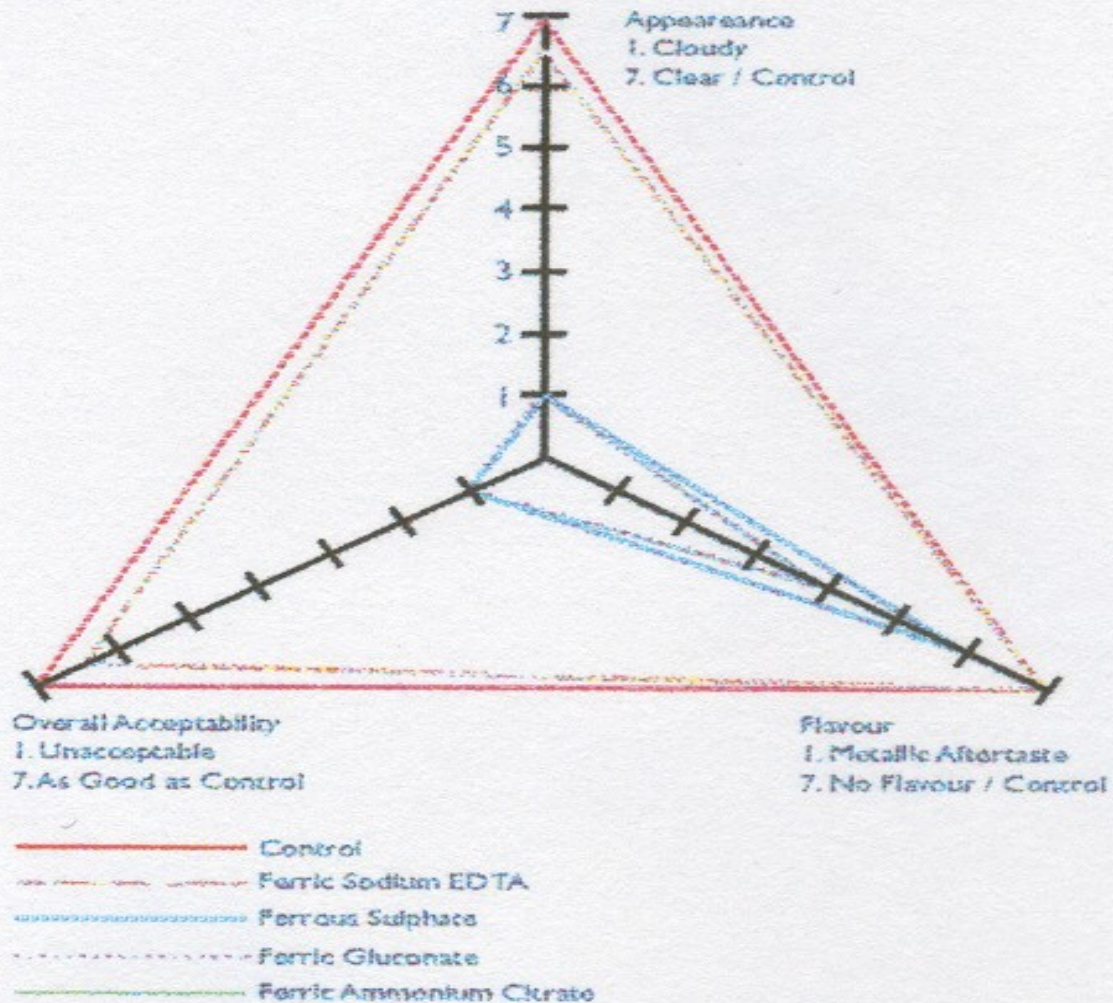


Figure 4. Sensory evaluation after 6 months.

Loong MN and Goo HK (2004): Iron Fortification of Beverages. School of Chemical and Life Sciences, Singapore Polytechnic. Unpublished.

Ferrazone[®] - Sensorial

Iron Source (5 mg Fe per serving)	Weeks in Accelerated Storage, 90 °F, 85% RH *)						
	2	4	6	8	10	12	16
Ferrous Sulfate	[Bar chart showing taste progression from acceptable to unacceptable]						
Sodium Iron EDTA	[Bar chart showing taste progression from acceptable to unacceptable]						
Encapsulated Ferrous Sulfate	[Bar chart showing taste progression from acceptable to unacceptable]						
Ferrochel	[Bar chart showing taste progression from acceptable to unacceptable]						
Ferrous Gluconate	[Bar chart showing taste progression from acceptable to unacceptable]						
Ferric Saccharide	[Bar chart showing taste progression from acceptable to unacceptable]						
Ferrous Citrate	[Bar chart showing taste progression from acceptable to unacceptable, with 'No data' at 12 weeks]						
Ferrous Fumarate	[Bar chart showing taste progression from acceptable to unacceptable, with 'No data' at 12 weeks]						
Ferrous Tartarate	[Bar chart showing taste progression from acceptable to unacceptable, with 'No data' at 12 weeks]						
Ferric Glycerophosphate	[Bar chart showing taste progression from acceptable to unacceptable, with 'No data' at 2 weeks]						

- Taste comparable to iron-free control
- Slight metallic taste, overall still acceptable
- Moderate metallic taste and some oxidized flavor, overall no longer acceptable
- Strong metallic taste and oxidized flavor, overall not acceptable

*) One week storage under these conditions is equivalent to 1.25 to 1.5 months under normal storage conditions

Ferrazone[®] - Mercado

- Sytron[®] - Austrália/UK
- Ferrostrane[®] - França
- Irostrene[®] - Noruega
- Plexofer[®] - Finlândia
- Fernobel[™]/V-Fer[™] - Índia



Ferrazzone® - Mercado

- Indonésia: Molho de Soja
- China: Molho de Soja/Suco de Fruta
- Vietnã/Tailândia: Molhos
- Filipinas: Molho de Tomate (Ketchup)
- Brasil: Refresco em Pó/Bebida Funcional para Mulher/Repositor Energético
- América Central: Cereal matinal
- ...E muito mais por vir!

Ferrazzone - Produtos



Ferrazone[®] – Custos

- Fonte de Ferro (7,5% da IDR)
- 80,8 mg Ferrazone/Litro
- R\$ 0,0045/Litro

- Alto Teor ou Rico em Ferro (15% IDR)
- 161,6 mg Ferrazone/Litro
- R\$ 0,0090/Litro

Conclusões

- Inovação - Alimentos Funcionais
- Agregação de Valor
- Versatilidade Técnica
- Funcionalidade
- Diferenciação no mercado
- Baixo Custo/Uso

Desenvolvimento de Alimentos que melhorem
a qualidade de vida das pessoas

“Uma seqüência de pequenos atos de vontade
conduz à grandes realizações”

Baudelaire

The logo for Vogler Ingredients features the word "Vogler" in a large, blue, sans-serif font with a registered trademark symbol. Below it, the word "Ingredients" is written in a smaller, blue, sans-serif font. To the left of the text is a grey square containing a stylized 'V' shape formed by two overlapping diagonal lines, one yellow and one red.

Vogler[®]
Ingredients



Prazer em nutrir bem...

Obrigado pela atenção!

Luis Fernando F. da Silva
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