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Suplementos e desporto na adolescência

Decreto-Lei n.º 136/2003

de 28 de Junho

Decreto-Lei n.º 118/2015

de 23 de junho

Artigo 3.º

Definições

Para efeitos do presente diploma, entende-se por:

- a) «Suplementos alimentares», os géneros alimentícios que se destinam a complementar e ou suplementar o regime alimentar normal e que constituem fontes concentradas de determinadas substâncias nutrientes ou outras com efeito nutricional ou fisiológico, estremes ou combinadas, comercializadas em forma doseada, tais como cápsulas, pastilhas, comprimidos, pílulas e outras formas semelhantes, saquetas de pó, ampolas de líquido, frascos com conta-gotas e outras formas similares de líquidos ou pós que se destinam a ser tomados em unidades medidas de quantidade reduzida;
- b) «Substâncias nutrientes ou nutrimentos», as vitaminas e os minerais;
- c) «Autoridade competente», a Direção-Geral de Alimentação e Veterinária (DGAV), enquanto organismo responsável pela definição, execução e avaliação das políticas de segurança alimentar.

Prevalência de uso em atletas

159 studies

60%

62%

Vitamin E
Protein
Creatine

58%

Iron

Dietary supplement	Sex	Studies (n)	SPE [% (S95 % CI)]
Any DS	M and F	61	60 (55–64)
	M	34	62 (56–69)
	F	31	58 (50–65)
Any vitamin/mineral	M and F	22	50 (43–57)
	M	9	50 (41–60)
	F	14	52 (43–62)
MVM	M and F	44	34 (30–40)
	M	21	37 (31–44)
	F	25	36 (29–44)
Vitamin A	M and F	10	6 (4–7)
	M	6	4 (2–8)
	F	5	3 (1–10)
Vitamin B or B complex	M and F	24	17 (12–23)
	M	12	18 (11–28)
	F	10	15 (9–23)
Vitamin C	M and F	34	32 (26–39)
	M	18	34 (25–44)
	F	20	31 (25–38)
Vitamin D	M and F	10	7 (3–15)
	M	5	10 (3–32)
	F	3	7 (2–28)
Vitamin E	M and F	24	13 (10–18)
	M	10	14 (8–23)
	F	7	8 (4–15)
Iron	M and F	30	17 (12–23)
	M	10	11 (5–24)
	F	18	23 (15–34)
Calcium	M and F	25	12 (8–18)
	M	7	20 (7–47)
	F	14	17 (11–25)
Zinc	M and F	10	7 (5–10)
	M	5	7 (4–12)
	F	5	5 (2–13)
Protein	M and F	33	27 (20–35)
	M	20	36 (25–49)
	F	15	12 (7–22)

Prevalence of Dietary Supplement Use by Athletes: Systematic Review and Meta-Analysis

Joseph J. Knapik^{1,2,3} · Ryan A. Steelman² · Sally S. Hoedebecke⁴ · Krista G. Austin^{1,3} · Emily K. Farina^{1,3} · Harris R. Lieberman¹

Sports Med (2016) 46:103–123

Dietary supplement	Sex	Studies (n)	SPE [% (S95 % CI)]
Amino acid	M and F	24	15 (12–20)
	M	15	15 (9–23)
	F	10	10 (3–23)
Creatine	M and F	24	14 (10–20)
	M	18	17 (11–26)
	F	14	3 (1–4)
<i>Echinacea</i>	M and F	7	12 (4–29)
	M	3	11 (3–40)
	F	4	13 (2–60)
Ginseng	M and F	9	8 (5–14)
	M	5	10 (6–17)
	F	5	8 (3–20)
Sport drink	M and F	17	28 (18–24)
	M	10	44 (24–66)
	F	8	35 (22–51)
Sport bar	M and F	9	34 (22–47)
	M	7	28 (14–56)
	F	3	32 (12–62)
Ω-3-fatty acid supplement	M and F	6	14 (8–24)
	M	4	21 (12–31)
	F	3	20 (12–32)
Energy drink ^b	M and F	3	34 (26–43)
	M and F	4	29 (16–46)
	M	2	20 (16–26)
	F	2	21 (16–24)

Table 5 Summary data on dietary supplement use in US national surveys

Survey	Study	Survey year(s)	n	Reporting timeframe	Prevalence (%)			
					Any VM		MVM	
					M	W	M	W
National Health Interview Survey (NHIS)	Subar and Block 1990 [183]	1987	9160 M, 12,920 F	Daily use	19	27	15	20
	Slesinski et al. 1995 [184]	1992	5120 M, 6885 F	Daily use	20	27	17	22
	Millens et al. 2004 [185]	2000	34,085 M and F	Daily use	29	39	24	33
National Health and Nutrition Survey (NHANES)	Koplan et al. 1986 [186]	1976–1980	5915 M, 6588 F	Use ≥ 1 time/wk	30	40	ND	ND
	Balluz et al. 2000 [187]	1988–1994	33,905 M and F	Use in last month	35	44	ND	ND
	Radimer et al. 2004 [188]	1999–2000	2260 M, 2602 F	Use in last month	46	57	32	38
	Kennedy et al. 2013 [189]	2007–2008	3364 M and F	Use in last month	42	54	ND	ND

Prevalência de uso em Portugal

Nutritional Supplements Usage by Portuguese Athletes

Mónica Sousa¹, Maria João Fernandes², Pedro Moreira^{2,3},
and Vítor Hugo Teixeira^{2,3}

n = 292

12-37y

13 sports

66%

4/at

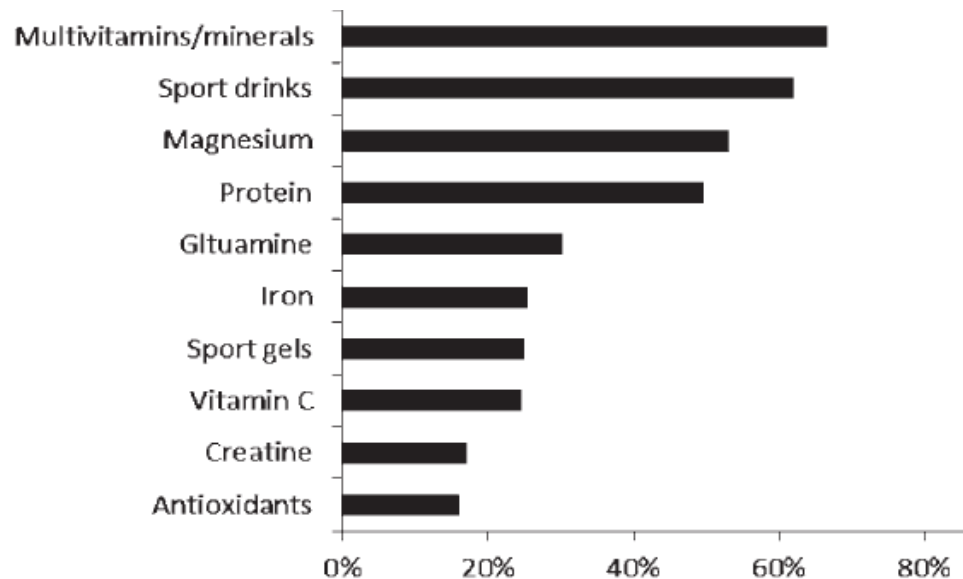


Table 1. Prevalence of dietary supplement use in young athletes

Author, year	N	Age (yrs)	Prevalence	3 Most Common Supplements (%)
Sobal and Marquart, 1994	742	High School students	38%	Vitamin C (25) Multivitamins (19) Iron (11)
Kim and Keen, 1999	1,355	16-19	35.8%	Vitamin C (41.2) Multivitamins (27) Calcium (10.7)
O'Dea, 2003	78	11-18	n/a	Sports drinks (56.4) Vitamin/minerals (48.7) Energy drinks (42.3)
Ziegler et al., 2003	105	16	71%	Multivitamin/mineral (M-61, F 83) Herbals (M-44, F-48) Multivitamin only (F-42) Protein bars (M-38)
Bell et al., 2004	333	13-19	n/a	Multivitamin/minerals (42.5) Protein (13.5) Energizers (6)
Nieper, 2005	32	18	62%	Multivitamins (45) Vitamin C (35) Iron (30)
Scofield and Unruh, 2006	139	14-19	22.3%	Meal replacement protein (23.7) Vitamin-minerals (19.4) Creatine (16)

Uso em atletas adolescentes

2012
9.417 athletes

Dietary Supplement Use by Children and Adolescents in the United States to Enhance Sport Performance: Results of the National Health Interview Survey

Marion Willard Evans Jr. · Harrison Ndetan ·
Michael Perko · Ronald Williams · Clark Walker

Supplement	National population estimates	NPE	Percent (SE)
Herbal supplement			
(Used in past 30 days)		81,365	5.5 (1.3)
Combination herb pill		5,717	8.1 (–)
Creatine		24,177	34.1 (–)
Evening primrose		10,144	14.3 (–)
Fiber or Psyllium		18,364	25.9 (–)
Fish oil or Omega 3 or DHA fatty acids		30,837	43.5 (–)
Soy supplements or isoflavones		2,982	4.2 (–)
Vitamin/mineral supplement			
(Used in past 30 days)		1,161,152	4.4 (0.5)
Multivitamin and/or mineral combination		1,088,488	94.5 (0.8)
Calcium		79,807	6.9 (1.0)
Chromium		1,603	0.1 (0.0)
Iron		1,621	0.1 (0.0)
Magnesium		1,603	0.1 (0.0)
Potassium		11,095	1.0 (0.0)
Vitamin A		1,847	0.2 (0.2)
Vitamin B complex		22,785	2.0 (0.2)
Vitamin B12		1,847	0.2 (0.2)
Vitamin C		39,232	3.4 (0.8)
Vitamin D		2,671	0.2 (0.0)
Vitamin packet		2,982	0.3 (0.0)

Uso em atletas adolescentes

2016

173 athletes

Dietary Intakes and Supplement Use in Pre-Adolescent and Adolescent Canadian Athletes

Jill A. Parnell ^{1,*}, Kristin P. Wiens ² and Kelly A. Erdman ³

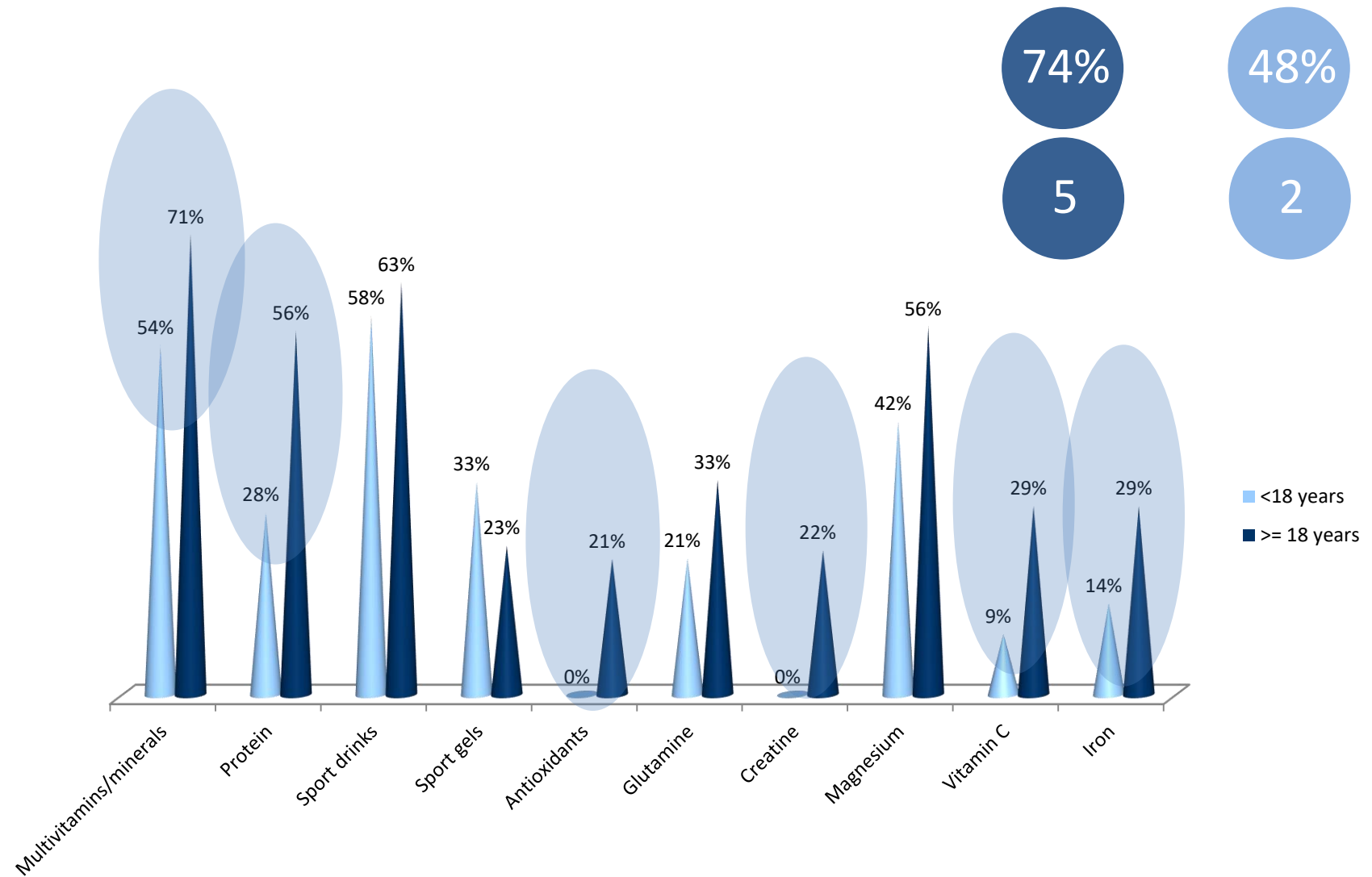
Supplement % Athletes	Males 11–13 (n = 26)			Females 11–13 (n = 36)			Males 14–18 (n = 52)			Females 14–18 (n = 59)			p
	R	O	N	R	O	N	R	O	N	R	O	N	
MVMM	46	15	39	36	19	44	40	19	40	22	27	51	0.346
B Vitamins	0	8	92	6	6	89	6	17	77	3	10	86	0.482
Vitamin C	15	23	62	19	31	50	27	23	50	19	27	54	0.862
Vitamin E	0	4	96	3	11	86	2	6	92	3	12	85	0.747
Vitamin D *	19	0	81	19	3	78	14	0	87	24	0	76	0.453
Vitamin Water	8	39	54	3	61	36	10	46	44	7	48	46	0.629
Iron	0	0	100	3	3	94	2	6	92	5	12	83	0.251
Calcium	0	0	100	6	8	86	8	10	83	3	7	90	0.471
Magnesium	0	4	96	3	3	94	2	6	92	0	2	98	0.735
Protein Powder	12	19	69	8	25	67	25	42	33	12	48	41	0.004
Beta Alanine	4	0	96	0	0	100	0	6	94	0	0	100	0.047
BCAA	4	0	96	3	0	97	2	6	92	3	2	95	0.598
Glutamine	4	0	96	0	0	100	0	4	96	0	2	98	0.230
Glucosamine	0	0	100	0	0	100	2	4	94	0	5	95	0.495
Fatty Acids	19	8	73	17	11	72	15	4	81	3	17	80	0.090
Sport Drink	15	65	19	8	69	22	19	71	10	7	70	24	0.264
Recovery Drink	15	8	77	0	14	86	4	23	73	5	17	78	0.109
Energy Drink	0	4	96	0	3	97	0	33	67	0	22	78	0.001
Sport Bar	15	46	39	14	69	17	33	50	17	25	51	24	0.110
Creatine	4	0	96	0	0	100	2	8	90	2	0	98	0.092
Caffeine	0	0	100	0	0	100	0	2	98	0	0	100	0.505
Gel/Gummy	8	46	46	0	47	53	2	29	69	0	37	63	0.079
Plant Extracts	4	31	65	3	39	58	2	31	67	3	37	59	0.968
Probiotics	4	19	77	3	19	78	0	14	87	0	20	80	0.559

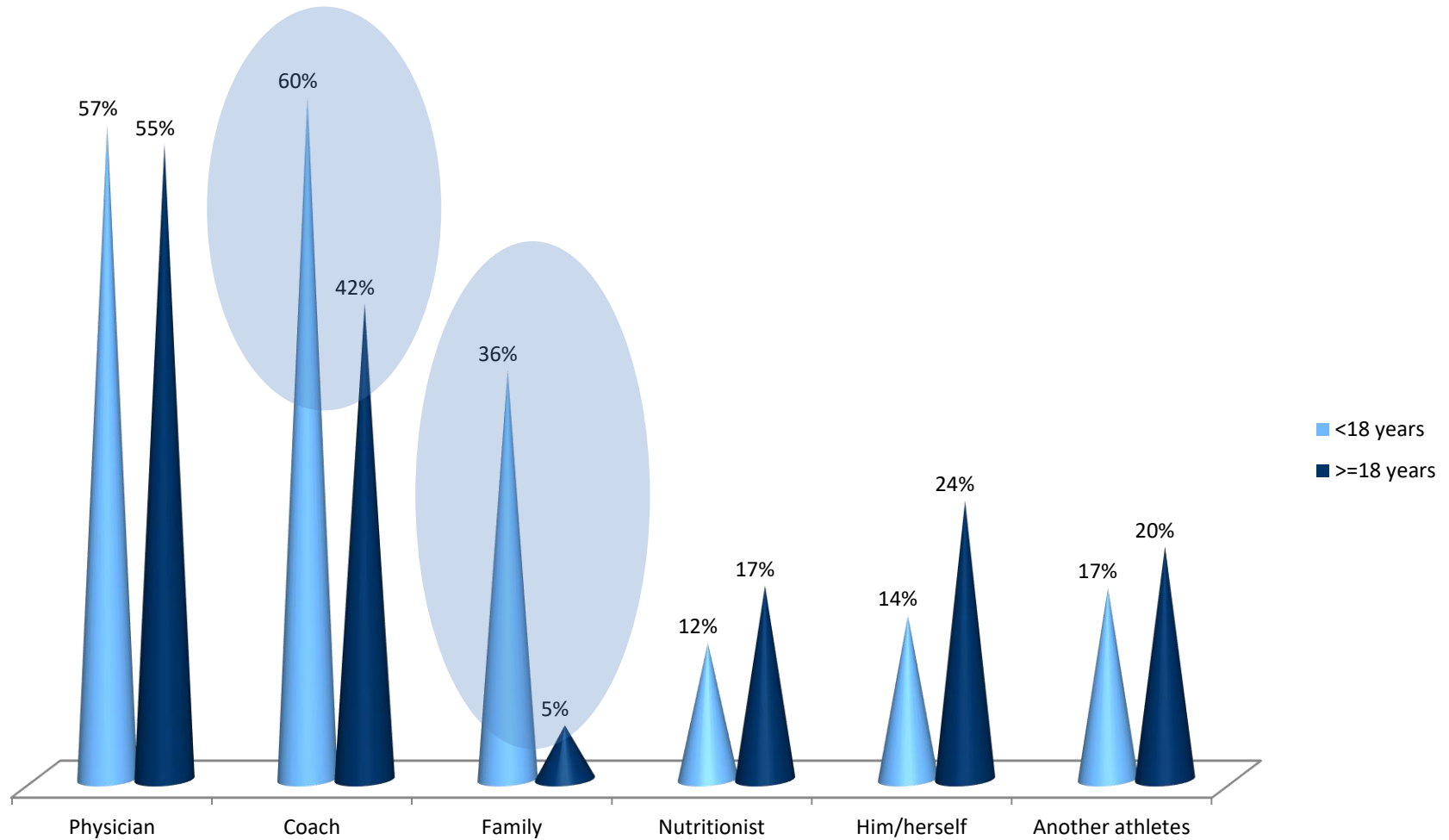
R: regularly, O: occasionally, N: never

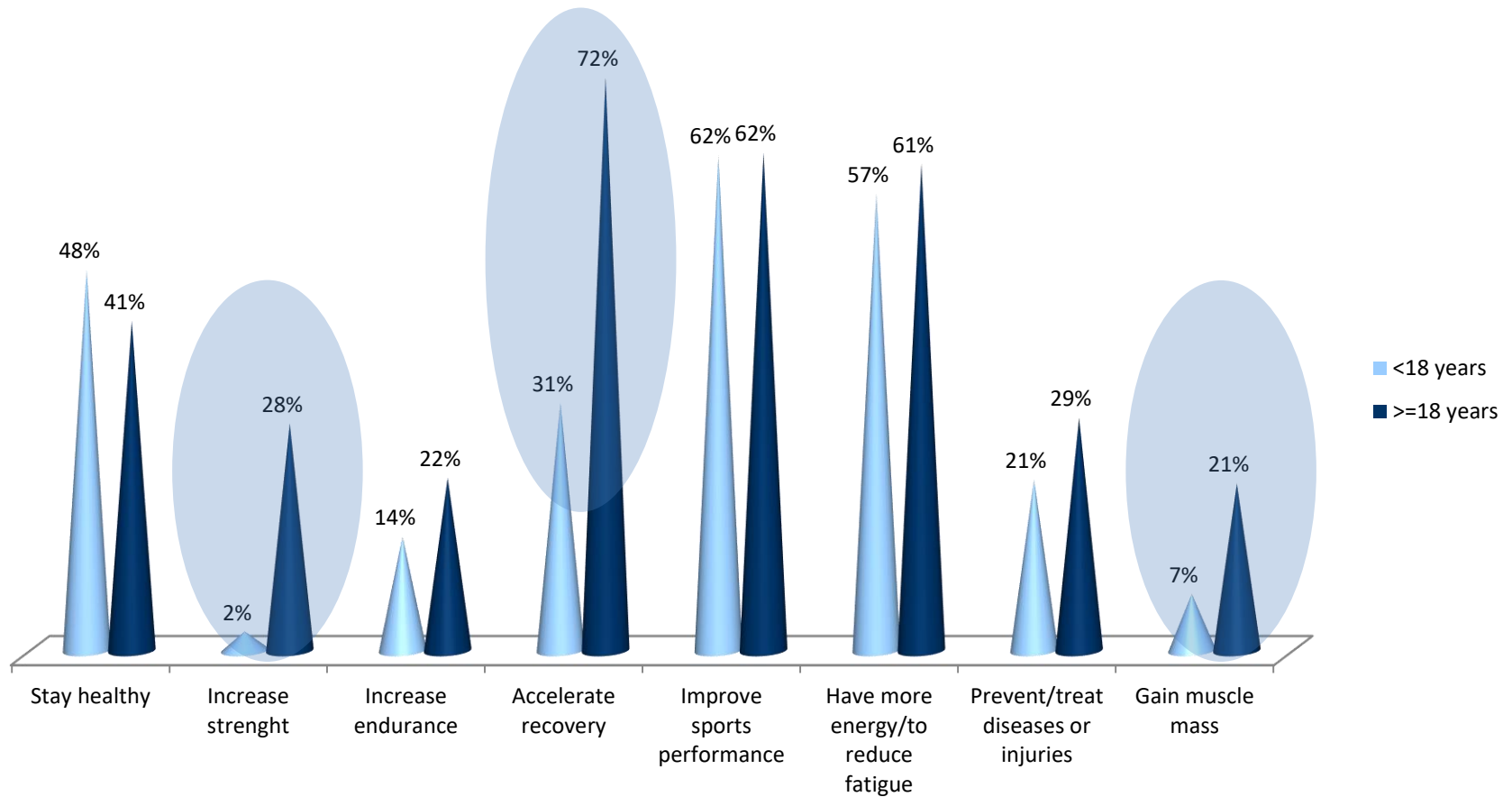
Tipo de suplementos

Nutritional Supplements Usage by Portuguese Athletes

Mónica Sousa¹, Maria João Fernandes², Pedro Moreira^{2,3},
and Vítor Hugo Teixeira^{2,3}







Use is common in attempts to enhance both physical **performance** and **appearance**

Determinants: **boy**, body dissatisfaction, higher **BMI**, training in a **gym**, exposure to appearance-oriented fitness **media**, risk-taking behaviors (**alcohol, drugs...**)

May be associated with **↑ risk of anabolic steroid use** and other risk behaviors

Findings: From the 241 athletes (66% males, 13–37 y), 64% reported NS use. After adjustment, supplement usage was associated with being ≥ 18 y (odds ratio [OR] 2.57, 95%; confidence interval [CI] 1.17–5.65), performing individual sports (OR 5.45, 95%; CI 2.49–11.93) and >2 h gym/week (OR 2.42, 95%; CI 1.15–5.11), a higher consumption of meat (OR 2.83, 95%; CI 1.36–5.90), eggs (OR 2.53, 95%; CI 1.07–5.96), and yogurt (OR 2.24, 95%; CI 1.08–4.62), and a lower intake of processed meat (OR 0.32, 95%; CI 0.15–0.72), vegetable oils (OR 0.35, 95%; CI 0.17–0.74), margarine (OR 0.37, 95%; CI 0.18–0.76), chips (OR 0.22, 95%; CI 0.10–0.48), and fast food (OR 0.42, 95%; CI 0.19–0.91).

Adequação nutricional

244 athletes
13 sports

Nutritional supplements use in high-performance athletes is related with lower nutritional inadequacy from food

Mónica Sousa ^a, Maria J. Fernandes ^b, Pedro Carvalho ^b, José Soares ^a, Pedro Moreira ^{b,c}, Vitor Hugo Teixeira ^{b,c,†}

Journal of Sport and Health Science xx (2015) 1–7

Table 3

Comparison of micronutrients intake from food between nutritional supplements users and non-users according to gender.

	Male				Female			
	User (n = 108)	Non-user (n = 52)	Crude <i>p</i> ^a	Adjusted <i>p</i> ^b	User (n = 45)	Non-user (n = 36)	Crude <i>p</i> ^a	Adjusted <i>p</i> ^b
Vitamin A (µg/d)	2549 (1708)	2543 (1986)	0.609	0.083	2863 (1822)	2110 (2312)	0.489	0.987
Vitamin C (mg/d)	164 (139)	163 (113)	0.179	0.053	223 (184)	188 (162)	0.899	0.684
Vitamin E (mg/d)	10.7 (7.1)	11.1 (4.8)	0.494	0.479	11.2 (6.7)	9.9 (6.3)	0.148	0.735
Vitamin D (µg/d)	5.5 (3.5)	5.0 (3.4)	0.460	0.768	5.4 (4.4)	3.4 (2.9)	<0.001*	0.036*
Thiamine (mg/d)	2.3 (1.1)	2.2 (1.1)	0.975	0.181	2.2 (1.2)	2.1 (1.3)	0.449	0.990
Riboflavin (mg/d)	3.3 (1.8)	2.9 (1.3)	0.509	0.026*	3.0 (1.9)	3.0 (1.8)	0.300	0.341
Vitamin B6 (mg/d)	3.3 (1.5)	2.8 (1.3)	0.308	0.205	3.2 (2.2)	2.9 (2.2)	0.207	0.381
Vitamin B12 (µg/d)	13.4 (8.3)	11.5 (9.2)	0.818	0.109	13.5 (11.6)	8.3 (7.0)	0.002*	0.076
Folate (µg/d)	510 (299)	461 (237)	0.334	0.032*	525 (279)	382 (384)	0.266	0.630
Magnesium (mg/d)	453 (220)	417 (164)	0.532	0.160	447 (205)	425 (229)	0.079	0.382
Zinc (mg/d)	17.0 (7.7)	15.7 (6.6)	0.584	0.293	16.4 (7.3)	14.4 (8.9)	0.116	0.165
Calcium (mg/d)	1388 (845)	1149 (738)	0.090	0.019*	1280 (827)	1285 (714)	0.508	0.335
Iron (mg/d)	22.4 (10.6)	21.0 (13.7)	0.853	0.225	20.1 (12.3)	16.8 (13.3)	0.155	0.931
Selenium (µg/d)	130 (60)	114 (73)	0.622	0.122	131 (83)	105 (56)	0.009*	0.020*

244 athletes
13 sports

Table 4
Comparison of PMI between nutritional supplements users and non-users according to gender.

	Male PMI		p^a	Female PMI		p^a	PMI		p^a	Total PMI ($n = 244$)
	User ($n = 108$)	Non-user ($n = 53$)		User ($n = 47$)	Non-user ($n = 36$)		User ($n = 155$)	Non-user ($n = 89$)		
Vitamin A	2 (2)	0	N.V.	0	0	N.V.	2 (1)	0	N.V.	2 (1)
Vitamin C	6 (6)	4 (8)	N.V.	1 (2)	1 (3)	N.V.	7 (5)	5 (6)	N.V.	12 (5)
VitaminE	62 (57)	30 (58)	0.555	23 (51)	24 (67)	0.118	85 (56)	54 (61)	0.229	139 (58)
Vitamin D	102 (94)	46 (89)	N.V.	38 (84)	36 (100)	N.V.	140 (92)	82 (93)	0.422	222 (92)
Thiamine	0	0	N.V.	0	0	N.V.	0	0	N.V.	0
Riboflavin	0	0	N.V.	0	0	N.V.	0	0	N.V.	0
Vitamin B6	0	0	N.V.	0	0	N.V.	0	0	N.V.	0
Vitamin B12	0	0	N.V.	0	0	N.V.	0	0	N.V.	0
Folate	21 (19)	13 (25)	0.272	7 (16)	12 (33)	0.054	28 (18)	25 (28)	0.049*	53 (22)
									($\phi = 0.118$; $p = 0.068$)	
Magnesium	25 (23)	12 (23)	0.580	2 (4)	10 (28)	0.004*	27 (18)	22 (25)	0.116	49 (20)
						($\phi = 0.326$; $p = 0.003$)				
Zinc	4 (4)	1 (2)	N.V.	0	3 (8)	N.V.	4 (3)	4 (5)	N.V.	8 (3)
Calcium	15 (14)	15 (29)	0.022*	9 (20)	15 (42)	0.030*	24 (16)	30 (34)	0.001*	54 (22)
			($\phi = 0.179$; $p = 0.023$)			($\phi = 0.236$; $p = 0.034$)			($\phi = 0.213$; $p = 0.001$)	
Selenium	1 (1)	0	N.V.	0	1 (3)	N.V.	1 (1)	1 (1)	N.V.	2 (1)

Nutritional Supplements Usage by Portuguese Athletes

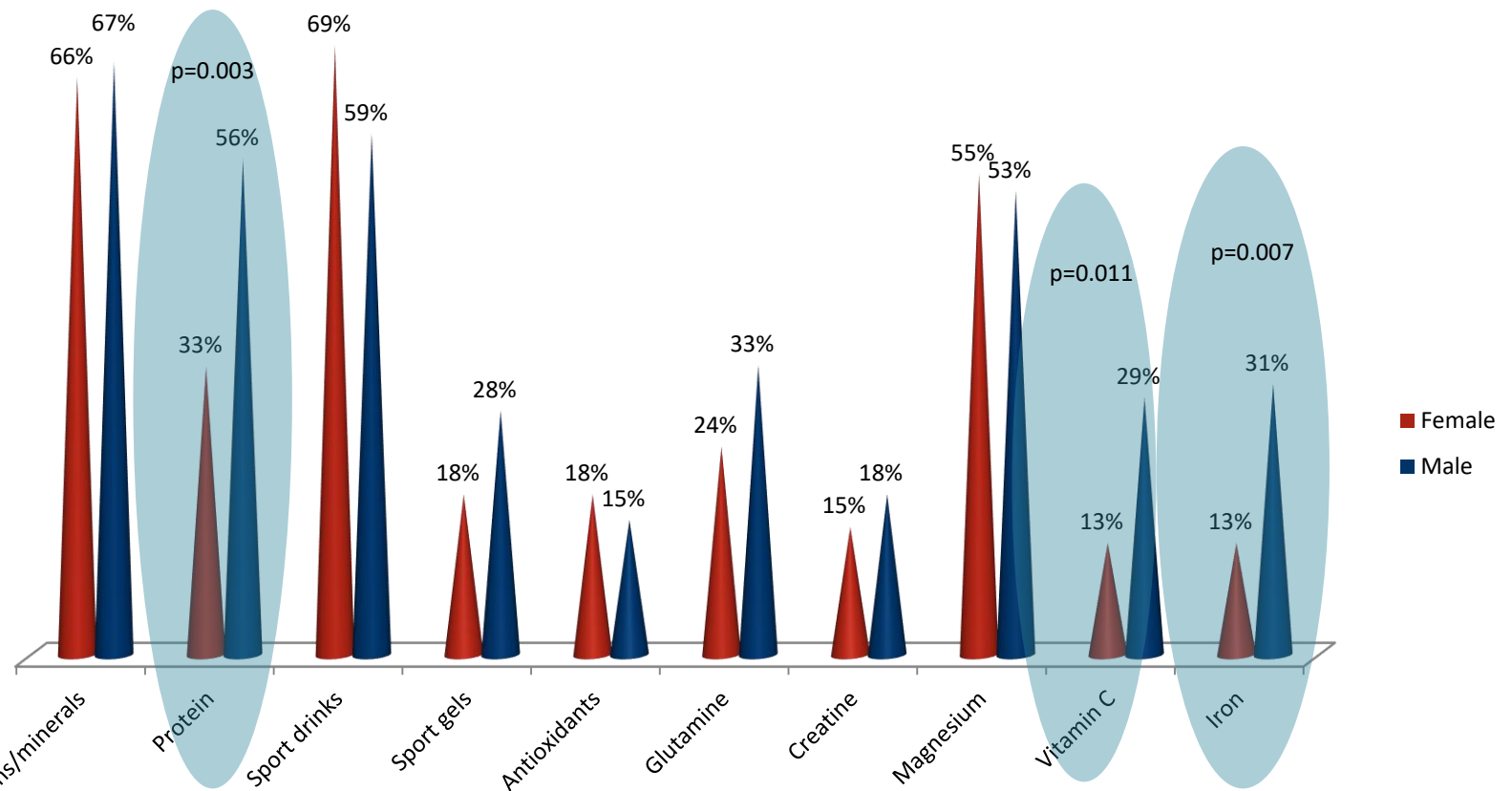
Mónica Sousa¹, Maria João Fernandes², Pedro Moreira^{2,3}
and Vítor Hugo Teixeira^{2,3}

Prevalência de uso por sexo em Portugal

n = 292

12-37y

13 sports



ORIGINAL ARTICLE

Iron excess in recreational marathon runners

S Mettler^{1,2} and MB Zimmermann^{3,4}

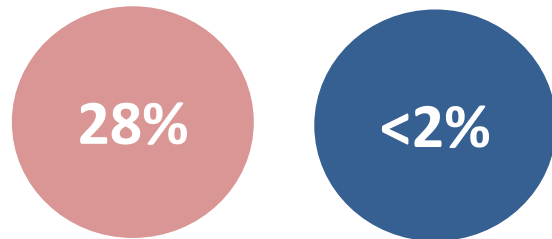
Estado nutricional em ferro

n=170 runners

Zurich marathon

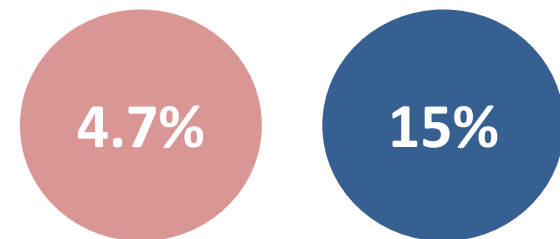
Iron depletion

(Ferritin <15µg/L)



Iron overload

(Ferritin >200µg/L)



Athletes' dietary intake was closer to French RDA's than those of young sedentary counterparts[☆]

Murielle Garcin^{a,b,*}, Laetitia Doussot^{a,b}, Laurence Mille-Hamard^c, Veronique Billat^c

187 athletes

Table 3. Micronutrient intakes from food sources.

Nutrient	Male 11–13 (n = 26)	Females 11–13 (n = 37)	Males 14–18 (n = 53)	Female 14–18 (n = 52)	p
Thiamin mg/day	1.9 (1.4–2.3)	1.4 (1.0–1.8)	2.1 (1.6–3.0)	1.6 (1.1–2.1)	0.073
%RDA	203 (140–240)	155 (112–204)	175 (137–246)	156 (113–213)	
Riboflavin mg/day	2.9 (2.2–3.9)	2.1 (1.6–3.0)	3.4 (2.6–4.1)	2.1 (1.4–2.7)	<0.001
%RDA	317 (248–434)	237 (182–336) ^a	258 (200–314) ^b	207 (143–271) ^{a,c}	
Niacin mg/day	40 (30–59)	33 (24–43)	45 (37–63)	37 (24–45)	0.024
%RDA	335 (250–494)	274 (200–359)	282 (230–393)	264 (173–325) ^c	
Vitamin B6 mg/day	2.1 (1.4–3.2)	1.3 (1.0–1.9)	2.4 (1.6–3.1)	1.6 (1.2–2.3)	0.002
%RDA	208 (142–315)	133 (104–193) ^a	185 (127–238)	132 (103–192) ^{a,c}	
Folate µg/day	412 (314–651)	309 (260–382)	486 (339–642)	357 (244–457)	<0.001
%RDA	138 (105–217)	103 (87–127) ^a	122 (85–161)	89 (61–114) ^{a,c}	
Vitamin B12 µg/day	5.5 (3.6–8.4)	4.0 (2.5–5.9)	7.5 (4.2–10.3)	3.5 (2.3–5.6)	<0.001
%RDA	303 (198–465)	223 (137–326)	313 (174–429)	147 (95–233) ^{a,b,c}	
Vitamin C mg/day	160 (65–262)	97 (54–141)	143 (81–279)	164 (105–240)	0.187
%RDA	356 (143–583)	216 (119–313)	191 (107–372)	252 (161–369)	
Vitamin D µg/day	8.4 (4.7–16.4)	4.3 (1.4–7.4)	9.2 (5.7–15.2)	3.1 (1.7–6.3)	<0.001
%RDA	56 (31–109)	29 (10–49) ^a	62 (38–101) ^c	21 (11–42) ^{a,c}	
Vitamin A RAE µg/day	933 (651–1191)	463 (287–842)	864 (702–1121)	697 (353–1065)	0.005
%RDA	156 (108–199)	77 (48–140) ^a	96 (78–125) ^b	100 (50–152) ^c	
Calcium mg/day	1419 (1113–2233)	1040 (715–1492)	1686 (1169–2251)	1090 (625–1377)	<0.001
%RDA	109 (86–172)	80 (55–115) ^a	130 (90–173) ^c	84 (48–106) ^{a,c}	
Iron mg/day	18 (12–20)	13 (10–17)	18 (15–22)	14 (11–17)	<0.001
%RDA	228 (150–250)	166 (130–211)	165 (137–195)	91 (72–112) ^{a,b,c}	
Zinc mg/day	14 (10–16)	10 (7–13)	15 (12–18)	9 (7–13)	<0.001
%RDA	177 (121–204)	121 (88–167) ^a	138 (107–166)	103 (79–140) ^{a,c}	
Potassium mg/day	3934 (3156–5150)	2534 (2125–3716)	4292 (3483–5012)	3240 (2274–3940)	<0.001
%AI	87 (70–114)	56 (47–83) ^a	91 (73–107) ^c	69 (48–84) ^{a,c}	
Sodium mg/day	3476 (2648–4573)	2701 (2089–3388)	3651 (2967–4676)	2928 (2144–3564)	<0.001
%AI	232 (177–305)	180 (139–226) ^a	243 (198–312) ^c	195 (143–238) ^a	



A B S T R A C T

Adequate adolescent nutrition is an important step for optimal growth and development. In this article, we systematically reviewed published studies till December 2014 to ascertain the effectiveness of interventions to improve adolescent nutrition. We found one existing systematic review on interventions to prevent obesity which we updated and conducted de novo reviews for micronutrient supplementation and nutrition interventions for pregnant adolescents. Our review findings suggest that micronutrient supplementation among adolescents (predominantly females) can significantly decrease anemia prevalence (relative risk [RR]: .69; 95% confidence interval [CI]: .62–.76) while interventions to improve nutritional status among “pregnant adolescents” showed statistically significant improved birth weight (standard mean difference: .25; 95% CI: .08–.41), decreased low birth weight (RR: .70; 95% CI: .57–.84), and preterm birth (RR: .73; 95% CI: .57–.95). Interventions to promote nutrition and prevent obesity had a marginal impact on reducing body mass index (standard mean difference: –.08; 95% CI: –.17 to .01). However, these findings should be interpreted with caution due to significant statistical heterogeneity.

Prós e contras

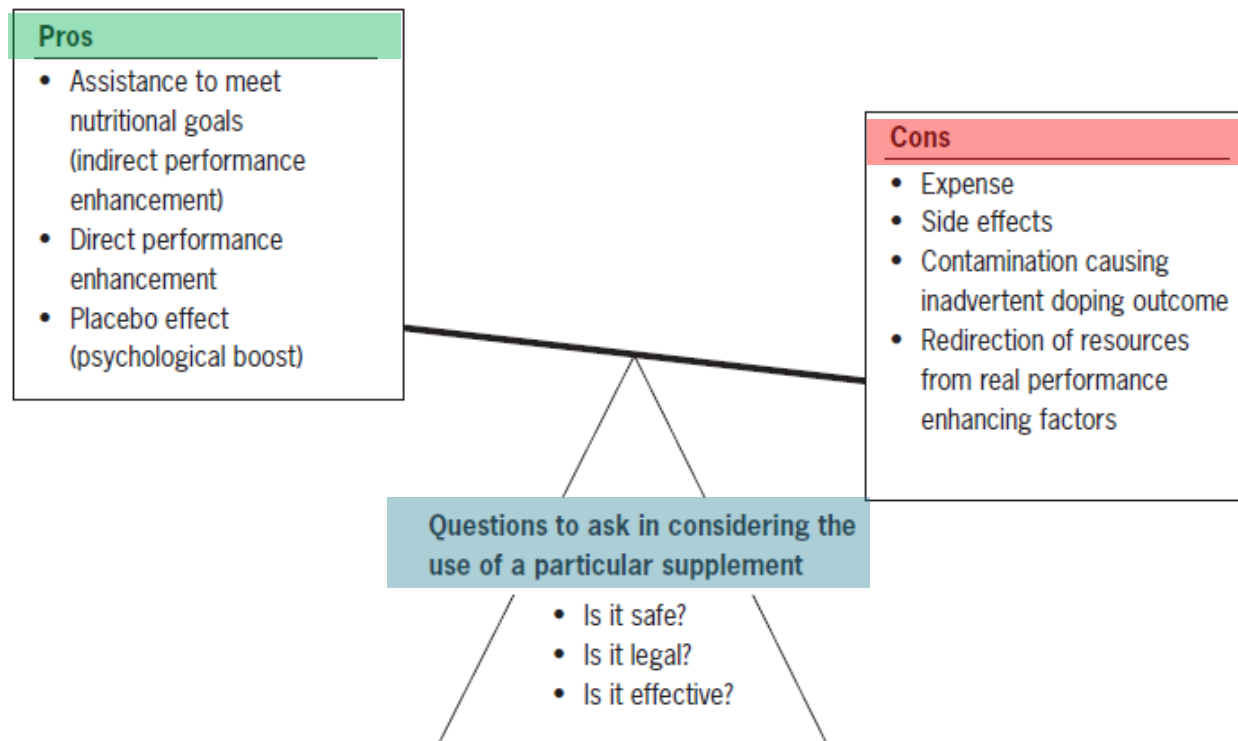
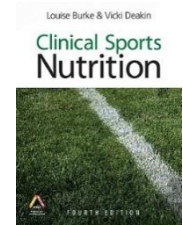


Figure 16.1 Issues to consider in the decision to take a supplement

1. Tomava uma substância ergogénica proibida que lhe garantisse uma medalha Olímpica sem a hipótese de ser apanhado?

98%

2. Tomava uma substância ergogénica proibida com a garantia de não ser apanhado e vencer todas as competições nos próximos 5 anos mas em que viria a morrer pelos seus efeitos adversos?

> 50%

Conclusions: Beta-carotene and vitamin E in doses higher than the RDA seem to significantly increase mortality, whereas we lack information on vitamin A. Dose of vitamin A was significantly associated with increased mortality in meta-regression. We lack information on doses below the RDA.

Oxidative stress

Antioxidant Status, Oxidative Stress, and Damage in Elite Trained Kayakers and Canoeists and Sedentary Controls

Vitor Teixeira, Hugo Valente, Susana Casal, Franklim Marques, and Pedro Moreira¹

Table 3 Participants' Antioxidant Status, Lipid Peroxidation, and Muscle-Damage Markers

	Kayakers and Canoeists (n = 17)		Controls (n = 17)		p
	M	SD	M	SD	
TAS (mmol/L)	1.03	0.17	1.18	0.20	.030
Uric acid (mg/dl)	4.97	1.37	5.44	0.81	NS
Glutathione peroxidase (U/L)	6,587	2,120	7,096	1,660	NS
Superoxide dismutase (U/g Hg)	1,234	212	1,041	117	.002
Glutathione reductase (U/L)	73.1	14.5	75.4	7.2	NS
α -Tocopherol (μ mol/L)	25.7	3.9	23.0	3.3	.037
Retinol (μ mol/L)	1.99	0.36	1.87	0.36	NS
α -Carotene (μ mol/L)	0.15	0.10	0.06	0.04	.003
β -Carotene (μ mol/L)	0.65	0.37	0.34	0.22	.007
Lycopene (μ mol/L)	0.39	0.10	0.40	0.15	NS
Lutein + zeaxanthin (μ mol/L)	0.33	0.14	0.29	0.08	NS
Creatine kinase (IU/L)	383	249	104	47	<.001
TBARS (μ mol/L)	4.93	1.32	3.75	1.24	.011

Note. TAS = total antioxidant status; TBARS = thiobarbituric-acid-reactive substances.

Antioxidant status, oxidative stress, and damage in elite kayakers after 1 year of training and competition in 2 seasons

Vitor Teixeira, Hugo Valente, Susana Casal, Laura Pereira, Franklim Marques, and Pedro Moreira

Table 3. Lipoproteins, antioxidant status, lipid peroxidation, muscle damage, inflammation, and physiological stress markers of kayakers throughout the study (means $\pm$ SD).

Parameters	T1	T2	T3
Total cholesterol (mg·dL ⁻¹)	166.7 $\pm$ 15.3	154.1 $\pm$ 8.2	143.1 $\pm$ 10.2
Triglycerides (mg·dL ⁻¹)	51.7 $\pm$ 4.4	106.9 $\pm$ 9.1*	84.3 $\pm$ 8.5*†
TAS (mmol·L ⁻¹)	1.43 $\pm$ 0.21	0.99 $\pm$ 0.07*	0.95 $\pm$ 0.19*
Uric acid (mg·dL ⁻¹)	4.61 $\pm$ 1.25	4.96 $\pm$ 1.25	4.01 $\pm$ 1.12†
GPx (U·L ⁻¹)	6224 $\pm$ 2420	5235 $\pm$ 1142	7602 $\pm$ 1704†
SOD (U·g ⁻¹ Hg)	1347 $\pm$ 159	1396 $\pm$ 133	1013 $\pm$ 77*†
Gr (U·L ⁻¹)	68.8 $\pm$ 9.5	67.1 $\pm$ 6.7	68.3 $\pm$ 12.1
α -tocopherol (μ mol·L ⁻¹)	22.1 $\pm$ 5.5	29.3 $\pm$ 3.6*	25.5 $\pm$ 6.0
α -tocopherol/total lipids (mmol·mol ⁻¹)	4.81 $\pm$ 1.52	5.67 $\pm$ 0.42	5.74 $\pm$ 1.41
Retinol (μ mol·L ⁻¹)	2.02 $\pm$ 0.50	2.29 $\pm$ 0.64	2.02 $\pm$ 0.31
α -carotene (μ mol·L ⁻¹)	0.19 $\pm$ 0.07	0.15 $\pm$ 0.07	0.18 $\pm$ 0.07
β -carotene (μ mol·L ⁻¹)	0.49 $\pm$ 0.21	0.57 $\pm$ 0.28	0.74 $\pm$ 0.43
Lycopene (μ mol·L ⁻¹)	0.62 $\pm$ 0.20	0.46 $\pm$ 0.17	0.48 $\pm$ 0.15
Lutein + zeaxanthin (μ mol·L ⁻¹)	0.41 $\pm$ 0.12	0.41 $\pm$ 0.21	0.31 $\pm$ 0.16
Vitamin C (μ mol·L ⁻¹)	63.0 $\pm$ 24.2	ND	ND
Creatine kinase (IU·L ⁻¹)	172 $\pm$ 69	317 $\pm$ 221	181 $\pm$ 90
TBARS (μ mol·L ⁻¹)	6.00 $\pm$ 1.21	4.64 $\pm$ 1.68*	5.28 $\pm$ 0.66
IL-6 (pg·mL ⁻¹)	1.47 $\pm$ 0.71	1.97 $\pm$ 0.30	2.15 $\pm$ 1.44
Cortisol (nmol·L ⁻¹)	223 $\pm$ 55	188 $\pm$ 33*	165 $\pm$ 35*†

Note: GPx, glutathione peroxidase; Gr, glutathione reductase; IL-6, interleukin-6; ND, not determined; SOD, superoxide dismutase; T3, June of season 2 (competitive period); TAS, total antioxidant status; TBARS, thiobarbituric acid reactive substances.

*Significantly different from T1 ($p < 0.05$).

†Significantly different from T2 ($p < 0.05$).

Antioxidants supplementation

Antioxidants Do Not Prevent Postexercise Peroxidation and May Delay Muscle Recovery

VITOR H. TEIXEIRA¹, HUGO F. VALENTE^{1,2}, SUSANA I. CASAL³, A. FRANKLIM MARQUES^{4,5}, and PEDRO A. MOREIRA^{1,2}

Oral administration of vitamin C decreases muscle mitochondrial biogenesis and hampers training-induced adaptations in endurance performance^{1–3}

Mari-Carmen Gomez-Cabrera, Elena Domenech, Marco Romagnoli, Alessandro Arduini, Consuelo Borrás, Federico V Pallardo, Juan Sastre, and Jose Viña

Antioxidants prevent health-promoting effects of physical exercise in humans

Michael Ristow^{a,b,1,2}, Kim Zarse^{a,2}, Andreas Oberbach^{c,2}, Nora Klötting^c, Marc Birringer^a, Michael Kiehnopf^d, Michael Stumvoll^c, C. Ronald Kahn^a, and Matthias Blüher^{c,2}

An antioxidant and multivitamin supplement reduced improvements in VO 2max (Article)

Skaug, A.^a, Sveen, O.^a, Raastad, T.^b  

J Physiol 591.20 (2013) pp 5047–5059

5047

Resveratrol blunts the positive effects of exercise training on cardiovascular health in aged men

Lasse Gliemann¹, Jakob Friis Schmidt¹, Jesper Olesen², Rasmus Sjørup Bienso², Sebastian Louis Peronard¹, Simon Udsen Grandjean¹, Stefan Peter Mortensen³, Michael Nyberg¹, Jens Bangsbo¹, Henriette Pilegaard² and Ylva Hellsten¹

Vitamin C and E supplementation hampers cellular adaptation to endurance training in humans: a double-blind, randomised, controlled trial

Göran Paulsen^{1,2}, Kristoffer T. Cumming¹, Geir Holden¹, Jostein Hallén¹, Bent Ronny Rønnestad³, Ole Sveen⁴, Arne Skaug⁴, Ingvild Paur⁵, Nasser E. Bastani⁵, Hege Nymo Østgaard¹, Charlotte Buer¹, Magnus Midttun¹, Fredrik Freuchen¹, Håvard Wiig¹, Elisabeth Tallaksen Ulseth⁶, Ina Garthe², Rune Blomhoff^{5,7}, Haakon B. Benestad⁶ and Truls Raastad¹

Vitamin C and E supplementation prevents some of the cellular adaptations to endurance-training in humans

Dale Morrison, Jed Hughes, Paul A. Della Gatta, Shaun Mason, Séverine Lamon, Aaron P. Russell, Glenn D. Wadley  

Ascorbic acid supplementation does not attenuate post-exercise muscle soreness following muscle-damaging exercise but may delay the recovery process

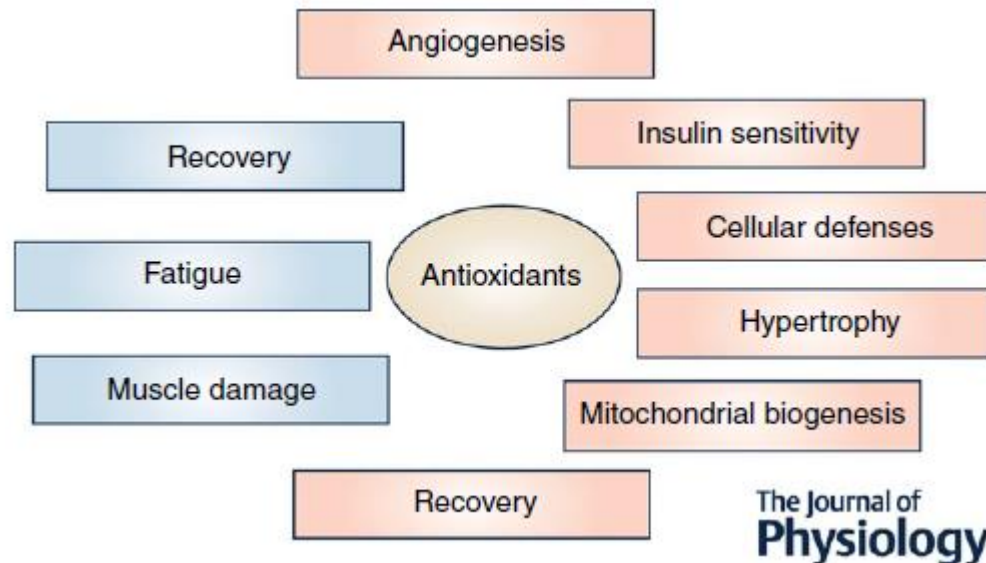
Graeme L. Close^{1*}, Tony Ashton², Tim Cable¹, Dominic Doran¹, Chris Holloway¹, Frank McArdle² and Don P. M. MacLaren¹

vhugoteixeira@fcna.up.pt

Pros and cons

Do antioxidant supplements interfere with skeletal muscle adaptation to exercise training?

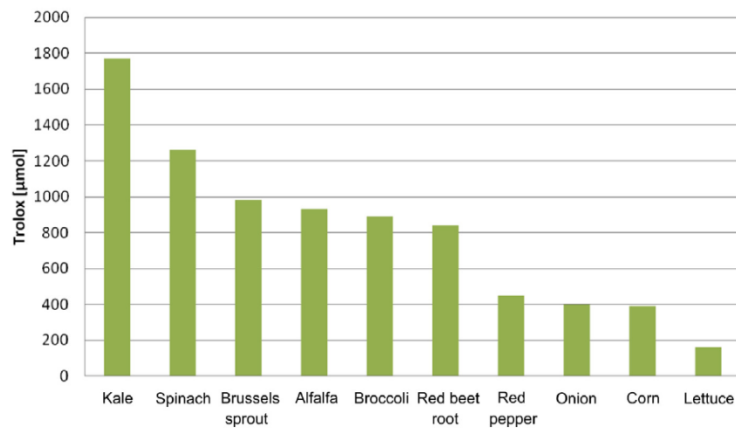
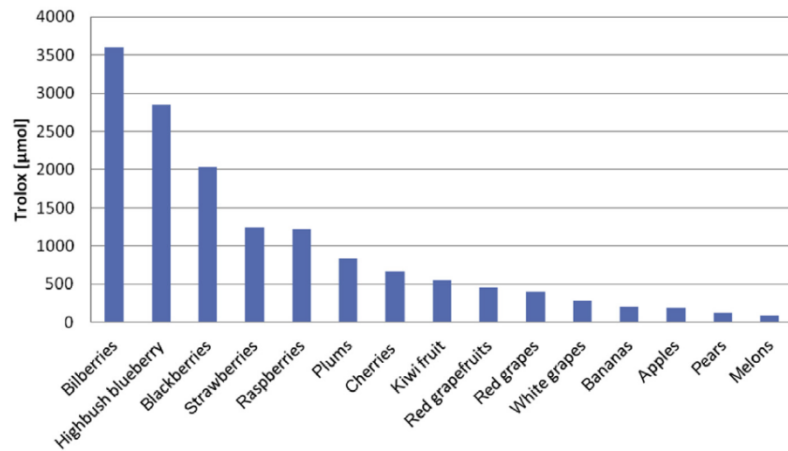
Troy L. Merry and Michael Ristow



AOX food sources

Effect of fruit and vegetable antioxidants on total antioxidant capacity of blood plasma

Joanna Harasym Ph.D., M.Sc., Eng*, Remigiusz Oledzki Ph.D., M.Sc.



Fruits and Vegetables Are Trying to Kill You

Antioxidant vitamins don't stress us like plants do—and don't have their beneficial effect.

BY MOISES VELASQUEZ-MANOFF
ILLUSTRATION BY JOHN HENDRIX
JULY 17, 2014



These investigations showed that nutritional supplements contained prohibited stimulants as ephedrines, caffeine, methylenedioxymetamphetamine and sibutramine, which were not declared on the labels. An international study performed in 2001 and 2002 on 634 nutritional supplements that were purchased in 13 different countries showed that about 15% of the nonhormonal nutritional supplements were contaminated with anabolic-androgenic steroids (mainly prohormones). Since 2002, also products

Sports and Exercise Nutrition Register (SENr)
Supplement use in Sport
Position Statement

44% of positive tests in the UK in 2012 attributed to the presence of prohibited substances in supplements

UK Anti-Doping

Box 1: Examples of nutritional supplements that have been contaminated with doping substances (in alphabetical order)

- Branched-chain amino acids (BCAAs)
- Carnitine
- Chrysine
- Conjugated linoleic acid (CLA)
- Creatine
- Glutamine
- Guarana
- Minerals
- Ornithine-alpha-ketoglutarate (OKG)
- Proteins
- Pyruvate
- Ribose
- Saw palmetto
- Tribulus terrestris
- Vitamins
- Zinc

Melhor solução é preferir os suplementos sujeitos a **análises laboratoriais** a substâncias dopantes, preferivelmente em **todos os lotes**.

English Deutsch
Find your supplement:
Search
Resources For Athletes and Coaches For Manufacturers and Suppliers Contact

What is Informed-Sport?

Informed-Sport is a quality assurance programme for sports nutrition products, suppliers to the sports nutrition industry, and supplement manufacturing facilities. The programme certifies that all nutritional supplements and/or ingredients that bear the Informed-Sport logo have been tested for banned substances by the world class sports anti-doping lab, LGC. Athletes choosing to use supplements can use the search function above to find products that have been through this rigorous certification process.

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Cologne List®

more safety through tested products



- ✓ Nutritional supplements and products can contain banned substances.
- ✓ Cologne List® is a list of nutritional supplements which have been tested for such substances.
- ✓ By only using products which are on Cologne List® athletes reduce the risk of unintentionally becoming the victims of doping.
- ✓ Cologne List® is not a recommendation to athletes that they should use a nutritional supplement. Our goal is solely to provide better information and to improve transparency!

TABLE 3. Dietary supplements and sports foods with evidence-based uses in sports nutrition.

Category	Examples	Use	Concerns
Sports food	Sports drinks Sports bars Sports confectionery Sports gels Electrolyte supplements Protein supplements Liquid meal supplements	Practical choice to meet sports nutritional goals especially when access to food, opportunities to consume nutrients or gastrointestinal concerns make it difficult to consume traditional food and beverages	Cost is greater than whole foods May be used unnecessarily or in inappropriate protocols
Medical supplements	Iron supplements Calcium supplements Vitamin D supplements Multi-vitamin/mineral n-3 fatty acids	Prevention or treatment of nutrient deficiency under the supervision of appropriate medical/nutritional expert	May be self-prescribed unnecessarily without appropriate supervision or monitoring

Fe

No evidence that adolescent athletes have higher requirements
Iron supplements guided by health professional with regular follow-up

Ca

The increase in BMC with weight bearing exercise is quite small (<6%) and unlikely to substantially increase calcium requirements in exercising adolescents

Vit.
D

Some at higher risk of vitamin D deficiency (>35°, training indoors) → monitoring

Specific performance supplements	Ergogenic effects	Physiological effects/mechanism of ergogenic effect	Concerns regarding use ^a
Creatine	Improves performance of repeated bouts of high-intensity exercise with short recovery periods - Direct effect on competition performance - Enhanced capacity for training	Increases Creatine and Phosphocreatine concentrations May also have other effects such as enhancement of glycogen storage and direct effect on muscle protein synthesis	Associated with acute weight gain (0.6–1 kg) which may be problematic in weight sensitive sports May cause gastrointestinal discomfort Some products may not contain appropriate amounts or forms of creatine
Caffeine	Reduces perception of fatigue Allows exercise to be sustained at optimal intensity/output for longer	Adenosine antagonist with effects on many body targets including central nervous system Promotes Ca ²⁺ release from sarcoplasmic reticulum	Causes side-effects (tremor, anxiety, increased heart rate, etc.) when consumed in high doses Toxic when consumed in very large doses Rules of National Collegiate Athletic Association competition prohibit the intake of large doses that produce urinary caffeine levels exceeding 15 ug/ml Some products do not disclose caffeine dose or may contain other stimulants
Sodium bicarbonate	Improves performance of events that would otherwise be limited by acid–base disturbances associated with high rates of anaerobic glycolysis - High intensity events of 1–7 minutes - Repeated high-intensity sprints - Capacity for high-intensity "sprint" during endurance exercise	When taken as an acute dose pre-exercise, increases extracellular buffering capacity	May cause gastrointestinal side-effects which cause performance impairment rather than benefit
Beta-alanine	Improves performance of events that would otherwise be limited by acid–base disturbances associated with high rates of anaerobic glycolysis - Mostly targeted at high-intensity exercise lasting 60–240 seconds - May enhance training capacity	When taken in a chronic protocol, achieves increase in muscle carnosine (intracellular buffer)	Some products with rapid absorption may cause paresthesia (tingling sensation)
Nitrate	Improves exercise tolerance and economy Improves performance in endurance exercise at least in non-elite athletes	Increases plasma nitrite concentrations to increase production of nitric oxide with various vascular and metabolic effects that reduces O ₂ cost of exercise	Consumption in concentrated food sources (eg, beetroot juice) may cause gut discomfort and discoloration of urine Efficacy seems less clear cut in high caliber athletes

Available Prevalence Data	Usual Form of Intake	Purported Mechanism of Performance Effect	Data on Performance Effects	Potential Adverse Effects
73% of children consume caffeine on any given day.²⁵ Median intake of those 12–19 y who ingest caffeine: 40.6 mg.²⁸	Caffeine is ubiquitous in a variety of food and beverages, as well as over-the-counter diet pills and “stay awake” medication.	Currently believed that performance benefit primarily due to central nervous system stimulation and enhanced muscle activation.	Most studies with caffeine have examined 3–6 mg/kg, but 1–3 mg/kg has been shown to have performance-enhancing effects, particularly in endurance activity.²⁶ This includes 4% improvements in strength of knee extensors (note: other muscle groups did not show strength improvements with caffeine); 14% in muscular endurance; and 10% to 20% improvements in time to exhaustion studies.	Tolerance. Cardiac arrhythmias (premature ventricular contractions) increased blood pressure. Headaches, irritability, sleep disruption, tremor. Gastric irritation. Increased core temperature with exertion, particularly in hot environments. Significant toxicity has been associated with ingestion of multiple energy drinks, leading to almost 1500 emergency department visits in 2011 in the 12- to 17-y age group.²⁷ Increased availability of pure powdered caffeine is of particular concern and is responsible for at least 2 deaths in young people (1 teaspoon of powdered caffeine is equivalent to 28 cups of coffee; FDA warning).

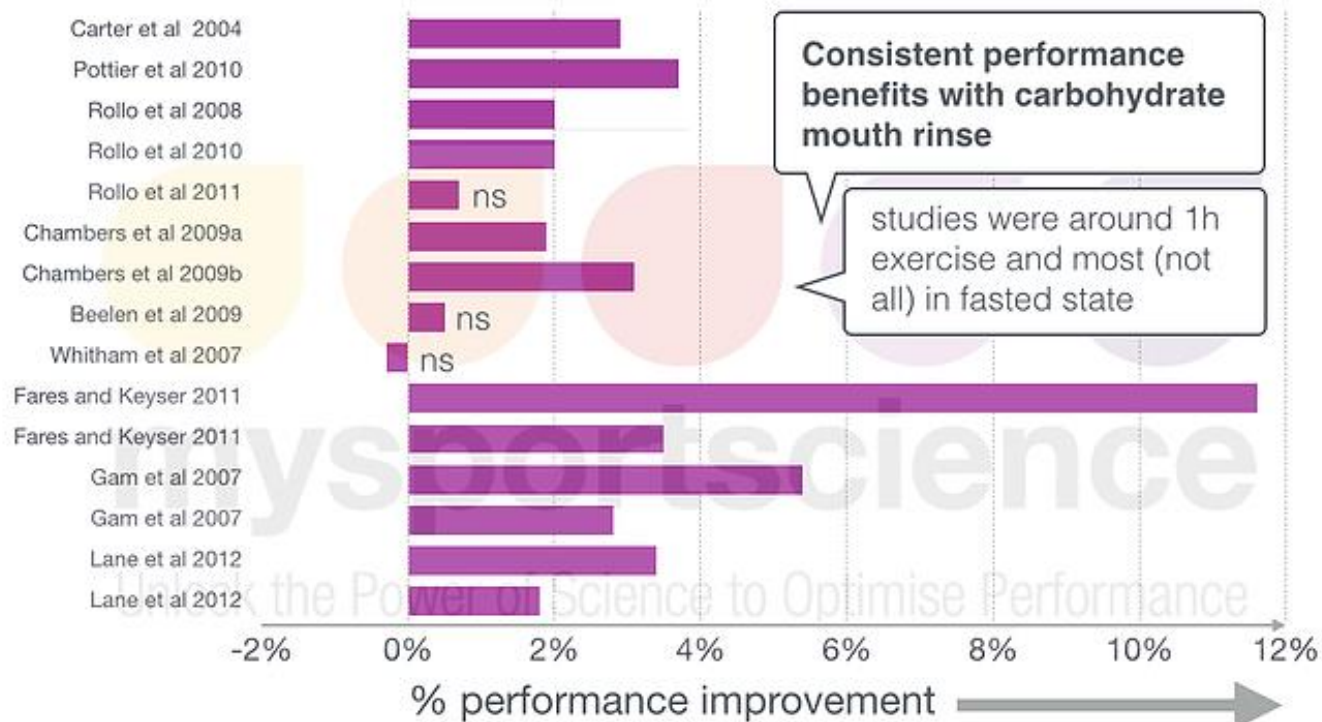
Table 1. Caffeine content of some common foods

Food/beverage	Serving size	Caffeine content, mg
Coffee	250 ml	
Brewed	250 ml	100–150
Drip	250 ml	125–175
Instant	250 ml	50–70
Espresso	1 shot	50–110
Tea		
Green (medium)	250 ml	25–40
Black (medium)	250 ml	40–60
Cola drinks	355 ml	35–50
Energy drinks	250 ml	80–150
Chocolate		
Dark	50 mg	20–40
Milk	50 mg	8–16

The primary dietary source of caffeine for children is soft drinks, which contain approximately 24 mg per serving (240 mL [8 oz]).²⁵ Ellison et al²⁶ reported that children 6 to 10 years old ingested caffeine on an average of 8 of 10 days. Other authors have reported variable caffeine intakes of up to 16 mg/day by 7- to 8-year-olds, 24 mg/day by 9- to 10-year-olds, and 37.4 mg/day by 5- to 18-year-olds.²⁷ Symptoms of

Rigorous review and analysis of the literature reveal that caffeine and other stimulant substances contained in energy drinks have no place in the diet of children and adolescents. Furthermore, frequent or excessive intake of caloric sports drinks can substantially increase the risk for overweight or obesity in children and adolescents. Discussion

Overview of studies Effects of carbohydrate mouth rinse on endurance performance



Sport drink

Induced beliefs about a fictive energy drink influences 200-m sprint performance[†]

Ricardo de la Vega, Sara Alberti, Roberto Ruiz-Barquín, István Soós & Attila Szabo 
Pages 1084-1089 | Published online: 27 Jun 2017

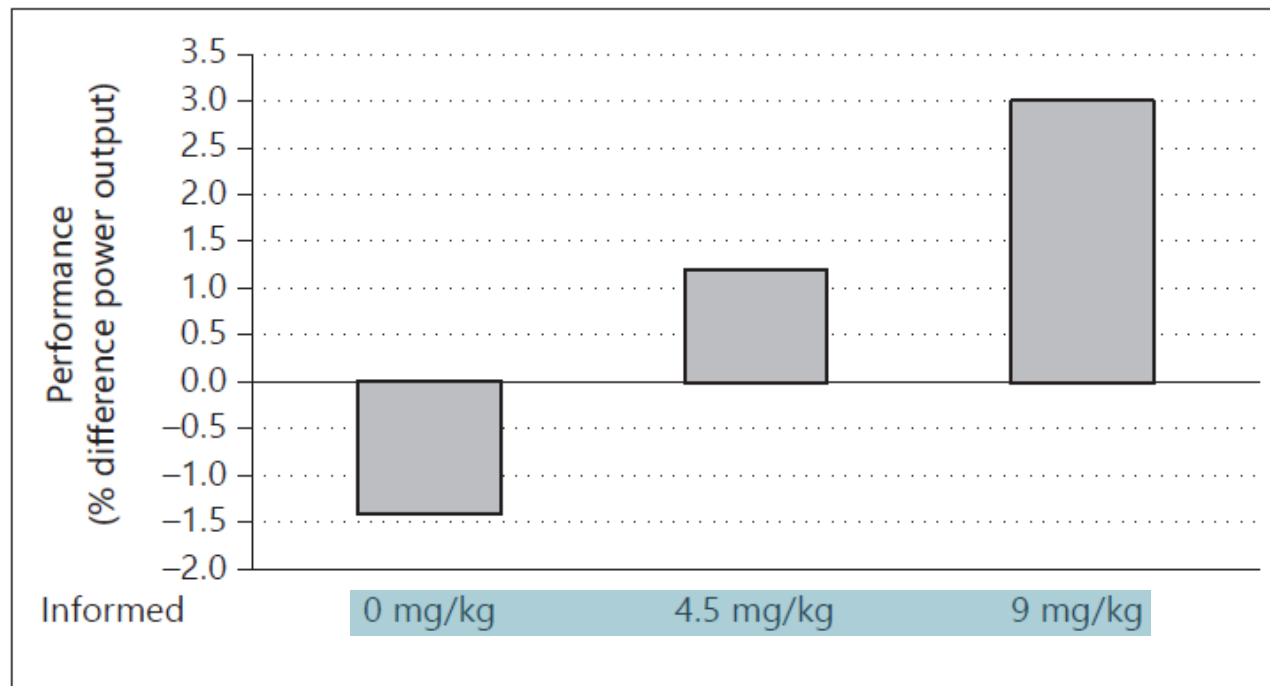


fictive and inert green colour energy drink

n=60, 3 groups, 200-m sprint

1. Drink **augments** running **performance** (positive information) **↓ 2.41 s**
2. Drink **may or may not** improve performance (partial-positive information) **↓ 0.97 s**
3. Drink **not improve** performance (neutral/control) **↓ 0.72 s**

10km TT



Efeito placebo

Placebo in sports nutrition: a proof-of-principle study involving caffeine supplementation

Scand J Med Sci Sports 2016:

42 cyclists,

30 min TT

1h before

6 mg/kg CAF, PLA and CON

		Post-exercise identification		
		Correct	Don't know	Wrong
CAF	<i>N</i>	20	8	14
	MPO (W)	236.4 ± 37.2*	234.1 ± 35.8	231.1 ± 39.0 [‡]
	CON	223.2 ± 39.7	236.0 ± 43.0	223.6 ± 35.6
	CAF vs CON	% difference +6.5 ± 6.6	−0.3 ± 0.2	+3.3 ± 5.2
	MBI	% chance of being beneficial/trivial/harmful 100/0/0	9/58/33	90/10/0
PLA	<i>N</i>	18	13	11
	MPO (W)	230.5 ± 43.4	223.6 ± 36.9	229.0 ± 30.1 [§]
	CON	233.8 ± 39.9	218.3 ± 42.7	221.3 ± 30.6
	PLA vs CON	% difference −1.6 ± 4.9	+3.2 ± 7.6	+3.7 ± 6.3
	MBI	% chance of being beneficial/trivial/harmful 1/52/47	67/31/2	87/13/1

p=0.06

Usual Form of Intake	Purported Mechanism of Performance Effect	Data on Performance Effects	Potential Adverse Effects
Creatine is found in meat and fish. Approximately 3–5 g/kg uncooked meat or fish. Cooking can degrade some creatine in food. Generally ~1 g/day found in omnivore diet. Orally ingested creatine monohydrate supplement.	Delays onset of muscle fatigue during high-intensity training by adenosine triphosphate production in high intensity activities that rely upon phosphocreatine shuttle.	Performance benefit in most studies is small and primarily seen in short-duration, maximum-intensity resistance training.²¹ No benefit generally shown in aerobic activities or with “on-field” athletic performance.	Short-term use at usual doses appears safe in normal adults, but has not been evaluated specifically in the pediatric population. Potential concern with impact on kidneys because of nephrotic metabolites (methylamine and formaldehyde), and specific recommendation against use for athletes at risk for kidney dysfunction.²² May impair performance in endurance activities.

Lower ability to regenerate high energy phosphates during high intensity exercise

Is being used in < 18yo athletes (Evans 2012)

The **safety** of creatine is **not established** for this age group

Available Prevalence Data	Usual Form of Intake	Purported Mechanism of Performance Effect	Data on Performance Effects	Potential Adverse Effects
Middle school girls: 25%. Middle school boys: 30%. High school girls: 18% High school boys: 39%. ¹¹	Variety of powders/bars/shakes.	Provides “building blocks” for muscle and lean tissue growth.	No performance benefit of protein supplement if diet provides adequate protein.	Contamination.

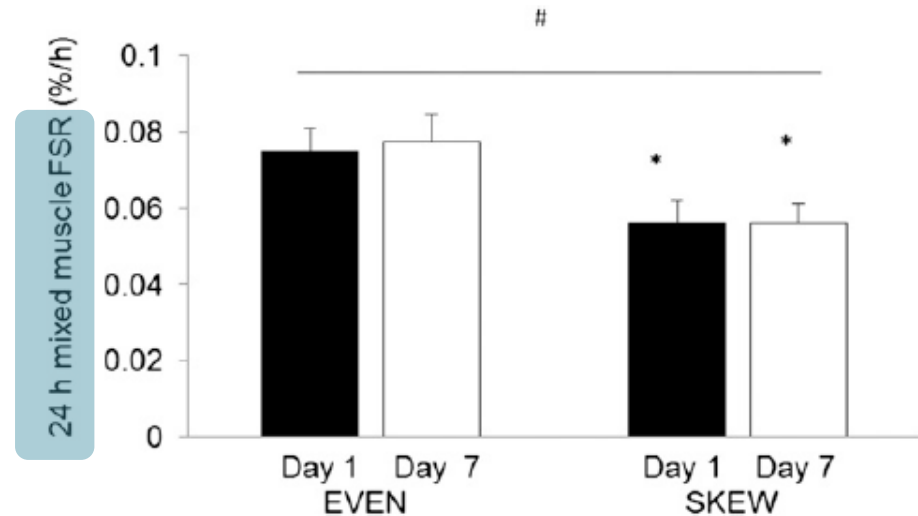
Distribuição da ingestão

Dietary Protein Distribution Positively Influences 24-h Muscle Protein Synthesis in Healthy Adults¹⁻³

Madonna M. Mamerow,⁴ Joni A. Mettler,⁴ Kirk L. English,⁴ Shanon L. Casperson,⁶ Emily Arentson-Lantz,⁴ Melinda Sheffield-Moore,⁶ Donald K. Layman,⁷ and Douglas Paddon-Jones^{4,5*}

Meal	Energy	Protein	Protein	Carbohydrate	Fat
	<i>kcal</i>	<i>g</i>	<i>g/kg</i>	<i>g</i>	<i>g</i>
Breakfast					
EVEN	848 ± 47.8	31.5 ± 1.3	0.41 ± 0.01	83.8 ± 2.8	43.0 ± 2.2
SKEW	537 ± 34.1	10.7 ± 0.8	0.14 ± 0.01	79.3 ± 7.4	19.7 ± 1.5
Lunch					
EVEN	820 ± 28.6	29.9 ± 1.6	0.39 ± 0.02	116 ± 11.1	26.0 ± 1.1
SKEW	683 ± 33.6	16.0 ± 0.5	0.21 ± 0.01	113 ± 9.5	18.4 ± 1.0
Dinner					
EVEN	727 ± 47.6	32.7 ± 1.6	0.42 ± 0.01	112 ± 7.3	16.4 ± 1.1
SKEW	1100 ± 49.3	63.4 ± 3.7	0.82 ± 0.03	115 ± 9.3	43.6 ± 1.4
Daily total ²					
EVEN	2400 ± 121	94.1 ± 3.7	1.22 ± 0.02	312 ± 17.8	85.4 ± 4.0
SKEW	2320 ± 113	90.1 ± 4.6	1.17 ± 0.04	307 ± 24.1	81.7 ± 3.0

+25%



Usual Form of Intake	Purported Mechanism of Performance Effect	Data on Performance Effects	Potential Adverse Effects
Oral supplements and high nitrate-containing foods (beets most commonly studied, but also found in lettuce, spinach, radish, celery).	Nitric oxide is a potent vasodilator. Synthesized from arginine via reduction to nitrate. Citrulline is an arginine precursor.	Any potential benefit of arginine appears minimal in healthy young athletes who ingest sufficient protein. ²⁴ Results are mixed regarding potential benefit of high nitrate-containing foods on athletic performance. ^{35,36} Study on junior rowers with 1.7% improvement in rowing time after repeat 500-m efforts. ³⁷	Supplementation with the amino acid arginine may create imbalance between other amino acids. Inorganic forms of nitrate are associated with carcinogenesis; however, current data do not support restriction of vegetable source of nitrates. ³⁶

Table 1. Estimated intakes of NO₃ from sources other than food additives at the global level (after Hambridge³⁴)

Regional diet	Intake (mg day ⁻¹)	ADI ^a (μg mg ⁻¹)	Major contributors to total intake (μg mg ⁻¹)			
			Vegetables	Water	Cereals	Fruit
Middle Eastern	40	200	650	200	100	50
Far Eastern	28	100	450	300	150	100
African	20	100	300	400	150	100
Latin American	55	250	650	150	50	100
European	155	700	900	50	<50	50

^a Based on 60 kg body weight.

Table 4. Classification of vegetables according to NO₃ content (mg kg⁻¹ fm)

Very low (<200)	Low (200–500)	Middle (500–1000)	High (1000–2500)	Very high (>2500)
Artichoke	Broccoli	Cabbage	Celeriac	Celery
Asparagus	Carrot	‘Cima di rapa’ (broccoli rab)	Chinese cabbage	Chervil
Broad bean	Cauliflower	Dill	Endive	Cress
Brussels sprouts	Cucumber	‘Radicchio’	Escarola	Lamb’s lettuce
Eggplant	Pumpkin	Savoy cabbage	Fennel	Lettuce
Garlic	‘Puntarelle’ chicory	Turnip	Kohlrabi	Radish
Onion			Leaf chicory	Red beetroot
Green bean			Leek	Rocket
Melon			Parsley	Spinach
Mushroom				Swiss chard
Pea				
Pepper				
Potato				
Summer squash				
Sweet potato				
Tomato				
Watermelon				

Added to cured and processed meats to fix colour and delay spoilage

Potential to form nitrosamines (if secondary amines present in saliva or stomach)

Limited data on the effects of nitrate supplementation by athletes

No $\neq$ in tyrosine nitration (Larsen 2011) and urinary nitrated protein levels (Bescós 2012)

Nitrosation inhibited by AOX in vegetables → unlikely to be harmful

Beeturia (red urine) and red stools in 4 of 47 studies

Usual Form of Intake	Purported Mechanism of Performance Effect	Data on Performance Effects	Potential Adverse Effects
Sodium bicarbonate or sodium citrate. Carnosine and β -alanine.	Buffers the metabolic acidosis resulting from high-intensity physical activity. β -alanine is a precursor of carnosine.	Data are variable regarding endurance exercise. ³⁸ Studies in adolescent swimmers with sodium bicarbonate reveal some swimmers with ~1-s improvement in 200-m efforts. ³⁹ Meta-analysis β -alanine with 2.85% median improvement in exercise lasting longer than 60 s. No benefit to exercise of shorter duration. ⁴⁰	Sodium bicarbonate with significant gastric upset in ~10%. β -alanine with paresthesias at higher doses. ³⁸

The position of SDA is that it is inappropriate and unnecessary for active and competitive adolescent athletes to consume dietary supplements for the purpose of performance enhancement. The use of supplements in developing athletes over-emphasizes their ability to manipulate performance in comparison with other training and dietary strategies.

Obrigado!