



Seasonal variation in food intake and the interaction effects of sex and age among adults in southern Brazil

Citation

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Table 1 Characteristics of the subjects and number of 24h dietary recalls according to seasons, sex, and age and body mass index.

Sample characteristics	N (%) or mean \pm SD		Total [n=273]
	Survey 1 [n=112]*	Survey 2 [n=161]**	
Gender			
Female	87 (78%)	113 (70%)	200 (73%)
Male	25 (22%)	48 (30%)	73 (27%)
Age			
20 – 44 years	34 (30%)	111 (69%)	145 (53%)
45 – 90 years	78 (70%)	50 (31%)	128 (47%)
Body mass index	25.7 (\pm 4.9)	23.9 (\pm 2.9)	24.7 (\pm 3.9)
24h Dietary recall	2 repeated measures [n=224]	2-4 repeated measures [n=588]	
Summer	20 (9%)	188 (35%)	208 (27%)
Autumn	11 (5%)	113 (21%)	124 (16%)
Winter	2 (1%)	155 (29%)	157 (21%)
Spring	191 (85%)	82 (15%)	273 (36%)

* Survey 1 – Data gathered in Porto Alegre with random sample (Two 24hDR)

** Survey 2 – Data gathered in Porto Alegre and São Leopoldo, with convenience sample (2 to 4 24h DR). Response rate: 85%.

Table 2 Mean food intake (grams per day) according to sex and age.

Food groups	Mean ± SE		P ¹	Mean ± SE		P ¹
	Women	Men		20-44	45-90	
¹ Fruits [g] & natural fruit juice [mL]	212.8 (± 285.5)	222.3 (± 297.6)	0.8	190.5 (± 251)	248.3 (± 338.7)	0.5
¹ Vegetables [g]	91.5 (± 81.8)	86.1 (± 81)	0.5	79.9 (± 80)	97.7 (± 83)	0.1
¹ Leafy vegetables [g]	46.6 (± 57.1)	43.4 (± 57.5)	0.4	39.6 (± 57.6)	50.4 (± 57.1)	0.07
¹ Potato & manioc not fried [g]	32 (± 46)	33.2 (± 45.6)	0.8	29.6 (± 45.2)	35.6 (± 46.6)	0.5
¹ Grains & derivatives [g]	256.5 (± 193.6)	238.8 (± 191.7)	0.2	234 (± 194.6)	261.3 (± 190.8)	0.1
¹ Beans & lentils [g]	74.7 (± 77)	71.7 (± 75.2)	0.7	67.9 (± 76.4)	78.5 (± 76)	0.3
¹ Lean Beef [g]	47.1 (± 60.6)	44.2 (± 60)	0.6	38.5 (± 60.4)	52.8 (± 60.3)	0.05
¹ Lean poultry [g]	13.8 (± 19.1)	14.1 (± 17.5)	0.9	12.8 (± 18.5)	15.1 (± 18.1)	0.6
¹ Fish & Seafood [g]	7.7 (± 46.4)	6 (± 34.2)	0.9	4.8 (± 28.6)	9.6 (± 55.4)	0.9
¹ Low fat Milk & light Yogurt [g]	55.7 (± 154.7)	80.5 (± 217.9)	0.7	68.5 (± 187.3)	65.5 (± 180.1)	0.9
¹ Light Cheese, cottage cheese & cream [g]	4 (± 18.5)	6.4 (± 18.3)	0.1	6.1 (± 18.5)	4.2 (± 18.3)	0.1
¹ Vegetable oil & unsalted margarine [g]	2.9 (± 5)	4.1 (± 5)	0.01	3.4 (± 5.1)	3.5 (± 5)	0.9
¹ Legumes, nuts & seeds [g]	13.9 (± 97.3)	12.1 (± 83.8)	0.9	12.3 (± 85.9)	13.7 (± 94.8)	0.9
Chocolate powder & sugar [g]	12 (± 25)	12.3 (± 24.6)	0.9	12.7 (± 24.9)	11.5 (± 24.7)	0.6
Sweets of all types [g]	67.7 (± 86.2)	50.1 (± 82.7)	0.05	53 (± 85.6)	64.8 (± 83.4)	0.2
Sweetened beverage [mL]	248.1 (± 292.8)	142.8 (± 289.1)	<0.001	165.1 (± 291.8)	225.8 (± 290.2)	0.05
Sweetened beverage diet & light [mL]	48.5 (± 141.8)	21.7 (± 62.7)	0.7	33.3 (± 96.9)	31.6 (± 91.7)	0.9
Alcoholic beverages [mL]	101.1 (± 517.4)	32.3 (± 160.2)	0.8	38.5 (± 194.5)	84.9 (± 426.3)	0.8
Coffee of all types [mL]	155 (± 289.2)	162.3 (± 286.3)	0.7	145.8 (± 290.6)	171.6 (± 285.3)	0.4
Whole Milk & Yogurt [g]	116.5 (± 201.3)	157.2 (± 198.1)	0.02	135.8 (± 200.3)	137.8 (± 199.2)	0.9
Whole Cheese, cottage cheese & cream [g]	22.8 (± 31.5)	19 (± 31.4)	0.2	18.1 (± 31.5)	23.8 (± 31.3)	0.09
Salty bakery & industrialized salty foods [g]	25.9 (± 193.6)	17.4 (± 129.8)	0.9	20.2 (± 151)	22.3 (± 166.5)	0.9
Animal fat & margarine with salt [g]	7.5 (± 9.4)	7.2 (± 9.3)	0.8	6.5 (± 9.2)	8.2 (± 9.5)	0.2
Fried foods of all kind [g]	29.7 (± 59.5)	15.4 (± 59.8)	<0.001	17.1 (± 59.9)	28 (± 59.4)	0.04
Eggs [g]	4.7 (± 6.9)	7.6 (± 6.4)	0.04	6.1 (± 6.2)	6.2 (± 7.1)	1.0
Fat beef [g]	56.6 (± 99.1)	26.1 (± 46.3)	0.6	31.6 (± 55.5)	46.7 (± 82.7)	0.6
Fat Poultry [g]	25.3 (± 65.8)	27.2 (± 69.8)	0.8	23.9 (± 61.6)	28.8 (± 74.7)	0.7
Other meat [g]	13.6 (± 37.2)	7.2 (± 19.2)	0.7	7.3 (± 19.6)	13.4 (± 36.5)	0.7
Processed meat [g]	24.9 (± 28.7)	18.5 (± 28.5)	0.02	20.1 (± 28.7)	23.3 (± 28.6)	0.3
Added salt [g]	0.50 (± 0.58)	0.33 (± 0.54)	0.2	0.40 (± 0.56)	0.43 (± 0.55)	0.8

¹ Food groups from the DASH diet;² P-value for differences between the food intake according to sex³ P-value for differences between the food intake according to age

Table 3 Mean food intake (grams per day) according to seasons.

Food groups	Summer		Autumn		Winter		Spring		P ³	P ⁴
	Mean (95% CI)	P ²	Mean (95% CI)	P ²	Mean (95% CI)	P ²	Mean (95% CI)	P ²		
¹ Fruits [g] & natural fruit juice [mL]	215.0 (164.0-281.9)	0.001	208.5 (160.6-270.6)	0.002	125.5 (91.8-171.7)	**	178.3 (144.5-220.0)	0.04	0.1	0.4
¹ Vegetables [g]	89.9 (73.1-110.5)	0.2	89.1 (68.4-116.0)	0.2	78.3 (59.9-102.4)	0.8	75.9 (62.1-92.8)	**	0.07	0.5
¹ Leafy vegetables [g]	39.0 (31.5-48.1)	0.09	30.3 (22.9-40.1)	**	42.7 (33.3-54.7)	0.04	47.8 (38.8-59)	0.001	0.7	0.001
¹ Potato & manioc not fried [g]	19.3 (12.8-29.2)	**	23.7 (14.2-39.7)	0.5	33.0 (20.3-53.7)	0.07	32.3 (21.5-48.3)	0.08	0.6	0.8
¹ Grains & derivatives [g]	250.0 (219.4-284.7)	0.2	233.8 (200.4-272.8)	0.7	265.5 (234.3-301.0)	0.03	226.2 (205.7-248.8)	**	0.02	0.9
¹ Beans & lentils [g]	59.3 (45.3-77.8)	**	70.3 (53.2-92.7)	0.3	77.2 (59.9-99.5)	0.08	68.8 (54.8-86.4)	0.4	0.7	0.01
¹ Lean Beef [g]	40.3 (29.1-55.8)	0.2	30.2 (20.2-45.0)	**	45.3 (32.0-64.2)	0.1	40.2 (31-52.2)	0.2	0.8	0.05
¹ Lean poultry [g]	7.1 (4.2-12.3)	1.0	15.8 (8.0-31.2)	0.1	18.5 (10.8-31.8)	0.02	7.1 (3.9-12.8)	**	0.8	0.01
¹ Fish & Seafood [g]	6.8 (3.4-13.6)	0.04	2.1 (0.8-5.5)	**	4.5 (1.9-10.5)	0.2	7.4 (3.8-14.5)	0.03	0.8	***
¹ Low fat Milk & light Yogurt [g]	58.9 (23.0-150.9)	0.7	72.1 (26.3-197.8)	0.5	47.8 (30.0-76.2)	**	67.6 (46.9-97.4)	0.1	0.08	0.007
¹ Light Cheese, cottage cheese & cream [g]	4.6 (2.6-8.3)	0.8	4.0 (1.9-8.5)	**	4.2 (2.2-8.0)	0.9	4.8 (3.2-7.1)	0.7	0.3	***
¹ Vegetable oil & unsalted margarine [g]	3.0 (2.0-4.4)	0.8	2.8 (1.7-4.5)	**	3.6 (2.6-5.0)	0.2	4.8 (4.1-5.7)	0.006	0.4	0.001
¹ Legumes, nuts & seeds [g]	2.4 (0.9-6.4)	**	4.4 (1.8-10.8)	0.3	2.5 (1.0-6.5)	1.0	4.6 (2.1-9.9)	0.2	0.8	0.6
Chocolate powder & sugar [g]	10.2 (7.4-14)	**	10.3 (6.8-15.6)	1.0	11.4 (7.8-16.7)	0.6	15.8 (12.5-19.9)	0.01	0.4	0.05
Sweets of all types [g]	51.6 (37.5-70.9)	0.1	36.5 (24.8-53.8)	**	44.6 (32.9-60.3)	0.3	48.7 (38.7-61.2)	0.2	0.6	0.7
Sweetened beverage [mL]	202.4 (133.7-306.5)	<0.001	201.1 (131.4-307.9)	0.001	85.0 (55.7-129.8)	**	141.8 (108-186.1)	0.002	0.8	0.7
Sweetened beverage diet & light [mL]	54.6 (27.8-107.0)	0.3	35.4 (18.7-67.2)	1.0	41.4 (20.8-82.4)	0.7	34.9 (19.6-62.0)	**	0.7	0.7
Alcoholic beverages [mL]	47.9 (24.5-93.6)	0.2	26.8 (13.1-55.2)	0.9	25.9 (12.9-52.3)	**	37.3 (19.6-71.1)	0.4	0.3	0.2
Coffee of all types [mL]	132.5 (105.1-166.9)	0.2	101.0 (67.9-150.2)	**	142.2 (108.3-186.9)	0.08	198.7 (143.3-275.7)	0.03	0.6	0.4
Whole Milk & Yogurt [g]	144.0 (112.6-184.1)	0.5	160.2 (120.9-212.3)	0.2	129.0 (95.0-175.0)	**	138.2 (111.8-170.7)	0.7	1.0	0.8
Whole Cheese, cottage cheese & cream [g]	19.1 (14.0-26.3)	0.1	23.3 (16.6-32.7)	0.01	16.5 (12.5-21.9)	0.3	13.8 (10.1-18.8)	**	0.8	0.6
Salty bakery & industrialized salty foods [g]	13.1 (7.7-22.4)	**	17.5 (8.9-34.4)	1.0	19.3 (11.1-33.5)	0.06	16.9 (10.0-28.8)	0.2	1.0	0.6
Animal fat & margarine with salt [g]	8.2 (6.1-11.1)	0.3	6.2 (3.7-10.4)	**	9.4 (6.7-13.1)	0.08	6.7 (5.1-8.9)	0.8	1.0	0.3
Fried foods of all kind [g]	15.8 (9.5-26.2)	0.4	12.3 (6.4-23.6)	**	20.6 (10.3-41.6)	0.2	14.8 (9.2-23.6)	0.6	0.8	0.7
Eggs [g]	6.3 (3.7-10.9)	0.005	5.2 (3.0-9.1)	0.02	1.6 (0.8-2.9)	**	6.7 (4.5-10.0)	<0.001	<0.001	0.7
Fat beef [g]	35.7 (23.6-53.9)	0.3	30.6 (19.7-47.5)	0.5	40.6 (22.7-72.7)	0.2	25.6 (16.1-40.6)	**	0.8	0.3
Fat Poultry [g]	21.6 (13.2-35.3)	**	27.1 (16.9-43.7)	0.4	23.1 (14.7-36.1)	0.8	22.4 (16.3-30.9)	0.9	0.01	0.3
Other meat [g]	6.5 (3.2-13.2)	0.4	3.8 (1.4-10.7)	**	8.6 (4.8-15.6)	0.08	4.6 (2.2-9.5)	0.8	0.9	0.9
Processed meat [g]	19.1 (13.7-26.5)	0.9	23.8 (17.5-32.4)	0.2	18.7 (14.0-25.0)	1.0	18.5 (14.2-24.1)	**	0.05	0.008
Added salt [g]	0.49 (0.27-0.90)	0.1	0.24 (0.14-0.39)	**	0.53 (0.35-0.78)	0.006	0.25 (0.17-0.36)	1.0	0.3	0.4

¹ Food groups from the DASH diet;

** Season with the lowest contribution to the total energy intake (%TEI) used as reference for multiple comparisons;

*** Interaction effect's test between season and age for intake of Fish & seafood, Light Cheese, cottage cheese & cream intake have been not feasible or reliable because of zero consumption in some strata.

² P-value for comparison between the food intake of the three seasons with which has the lowest food intake (g or mL/day), adjusted by sex, age, BMI.

³ P-value for interaction effect between season and sex.

⁴ P-value for interaction effect between season and age.

Supplemental table Food items classification into food groups.

Food Groups	Food items	Preparation method
¹ Fruits [g] & natural fruit juice [mL]	Avocado, pineapple, acai, banana, plum, tangerine, star fruit, fresh coconut, fig, guava, kiwi, orange, lime, lemon, apple, apple green, papaya, melon, watermelon, mango, strawberry, nectarine, pear, peach, fruit salad, cherry, grape, lemonade Switzerland, natural coconut water, and juices made with fresh fruit.	Fresh, squeezed and crushed
¹ Vegetables [g]	Squash, zucchini, garlic, leek, eggplant, beets, broccoli, sprouts of alfalfa and beans, onion, cucumber, bell pepper, chayote, carrots, mushroom, asparagus, turnip, cauliflower, radish, tomato, green beans, select the vegetables.	Fresh, grilled, boiled, mashed and steamed.
¹ Leafy vegetables [g]	Watercress, lettuce, chicory, Chinese cabbage, kale, spinach, mustard, cabbage, red cabbage, arugula, green seasoning.	
¹ Potato & manioc not fried [g]	Potato, manioc, sweet potato, cassava flour, yams.	Baked, grilled, boiled, mashed and steamed.
¹ Grains & derivatives [g]	Whole rice, white rice, oatmeal, cookies, crackers, flour, corn starch, corn cereals, cereal bars, bran and oatmeal, granola, bread, white bread, <i>polenta</i> ² , quinoa, tabbouleh salad, popcorn, wheat, pasta.	Boiled, stewed and baked.
¹ Beans & lentils [g]	Azuki beans, white beans, brown beans, black beans, soup beans, lentils, lentil soup.	Boiled and served hot or cold (such a salad)
¹ Lean Beef [g]	All types of beef without fat or originally lean.	Cooked, baked, grilled, stewed.
¹ Lean poultry [g]	All types of poultry without skin.	Cooked, baked, grilled, stewed.
¹ Fish & Seafood [g]	Shrimp, fish fillet, squid, octopus, salmon.	Cooked, baked, grilled, and stewed.
¹ Low fat Milk & light Yogurt [g]	Low fat yogurt, lacteal drink, skimmed milk in powder or liquid forms.	Fresh
¹ Light Cheese, cottage cheese & cream [g]	Skimmed cream, low fat cream cheese, cheeses such as mozzarella, rennet, minas cheese, and ricotta with reduced fat contents.	
¹ Vegetable oil & unsalted margarine [g]	Soy, corn, rice, canola, olive oils, low fat or light mayonnaise and unsalted margarine.	Used in the preparation of foods, in the breakfast, snacks, and in salads
¹ Legumes, nuts & seeds [g]	Soy and soy based food products; Nuts such as chestnuts, walnuts, Brazil nuts, almonds, hazelnuts, and peanuts; seeds of linseed, sunflower and sesame.	Fresh, salted, baked, crushed or squeezed.
Chocolate powder & sugar [g]	Chocolate powder, white sugar, brown sugar, honey and molasses.	
Sweets of all types [g]	Industrialized and homemade desserts, cakes, pies, jellies, chocolates, candies, filled biscuits, fruit compote, ice cream, candy toppings, syrups, condensed milk, fresh bakery, sweet breads, coconut industrialized.	Industrialized or homemade prepared.
Sweetened beverage [mL]	Soft drinks, industrialized fruit juices.	Marketed as canned, bottled and powder forms.
Sweetened beverage diet & light [mL]	Soft drinks, industrialized fruit juices free or reduces sugar contents.	Marketed as canned, bottled and powder forms.
Alcoholic beverages [mL]	Beer and distilled alcoholic beverages.	Industrialized
Coffee of all types [mL]	Cappuccino, mocaccino ³ , express, with or without milk.	Industrialized
Whole Milk & Yogurt [g]	Yogurt, milk drink, whole milk in powder or liquid forms.	Industrialized
Whole Cheese, cottage cheese & cream [g]	Whole cream, cream cheese, cheeses such as cheddar, emmental, gorgonzola, mozzarella, provolone, Swiss, parmesan, rennet, Roquefort, polenghi.	Industrialized
Salty bakery & industrialized salty foods [g]	Pastry, meat or vegetables based pies, quiches, croquettes, croissants, baked pastries; breads baked burger not fried and industrialized salty biscuits.	Industrialized and produced in bakeries.
Animal fat & margarine with salt [g]	Bacon, lard and butter salted and unsalted.	Industrialized or home-grown
Fried foods of all kind [g]	Meatloaf, banana, vegetables, cake, potatoes, cassava, eggs, pastel, kebab, <i>polenta</i> ¹ , cheese.	Homemade, in restaurants or cafeterias.
Eggs [g]	Chicken and quail eggs.	Boiled, scrambled, omelet.
Fat beef [g]	All types of beef with fat or originally fatty.	Cooked, baked, grilled, stewed, barbecue.
Fat Chicken [g]	All types of poultry with skin.	Cooked, baked, grilled, stewed, barbecue.
Other meats [g]	Pork, lamb, hunting and chicken and bovine hearts, intestines, liver and kidney	Homemade or prepared in restaurants
Processed meats [g]	Pepperoni, ham, bologna, sausage, hamburger, sausage and pate	
Addicted salt [g]	Salt added to the salads, homemade or traditional restaurants recipes.	

¹ Food groups from the DASH diet; ² Food typically eaten mostly by Italian immigrants, prepared with corn flour, spices and salt, boiled still became a cream; ³ Coffee prepared with chocolate, sugar, coffee and milk.

