



Relationship among dietary patterns, apolipoproteins, C-reactive protein and other lipids in adult populations in four cities of the Southern Cone of Latin America

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Introduction: An unhealthy dietary pattern affects plasma levels of lipids, inflammation biomarkers and other cardiovascular risk factors. No studies address this research question at population level in the Southern Cone of Latin America.

Objective: The present study aimed to identify the major dietary patterns in the population of the Southern Cone and explore whether those dietary patterns are associated with Apo A1, Apo B, C-reactive protein and other lipids.

Population: CESCAS I is an observational prospective cohort study with a multistage probabilistic sample of 7524 participants aged 35-74 years from four mid-sized cities representing the Southern Cone of Latin America. A subsample of 995 subjects was randomly selected from the primary cohort. Subjects with previous cardiovascular events or under lipid-lowering agents were excluded.

Methods: We conducted an ancillary cross-sectional study nested in a population-based cohort study. Diet was assessed using a previously validated 126-item food frequency questionnaire (FFQ).

Results: We found two major dietary patterns. **Prudent:** characterized by intake of fruit, vegetables, low-fat dairy products, whole cereal, fish and seafood. **Western-like:** was characterized by intake of meat, processed foods, pizza, turnovers, sweets and desserts, refined grains, vegetable oils and other fats.

Food items were collapsed into 36 predefined groups according to their habitual culinary use or nutrient composition. We conducted a principal components factor analysis (FA) to derive major dietary patterns.

The number of factors retained was based on the following criteria: components with an eigenvalue > 1, scree plot test and the interpretability of the factors. Food items were considered to load on a factor if they had an absolute correlation $\geq .30$. Two main factors with Eigen values > 1.20, which together accounted for 17.7% of the total variation, were extracted after orthogonal (varimax) rotation. All analyses were performed separately for women and men. To describe the univariate associations between dietary patterns and CVD risk factors we used simple linear regression models computing the p-value for each trend and chi-square test for categorical variables. Linear trends tests will be conducted to assess the associations with multiple regression analysis. Age, smoking status, education, body mass index, energy intake, alcohol consumption, physical activity and diabetes were selected as potential confounding factors.

Table 1. Food-group loadings for dietary patterns

	Prudent	Western like
Other vegetables	0.78	
Green, leafy vegetables	0.65	
Fruit	0.62	-0.19
Cruciferous vegetables	0.60	-0.10
Dark-yellow vegetables	0.59	
Tomato	0.52	
Fish and other seafood	0.44	0.13
Potatoes and tubers	0.39	0.36
Whole grains and Legumes	0.27	
Tea	0.25	-0.13
Low-fat dairy	0.25	
Nuts	0.16	0.15
Cold breakfast cereal and cereal bars	0.15	
Bovine meat/beef (Fatty cuts)		0.60
Processed Meat		0.56
Bovine meat/beef (Lean cuts)	0.12	0.51
Vegetable oils	0.21	0.48
Pastry and cakes		0.46
Mayonnaise and other dressings		0.44
Pizza and turnovers (Empanadas)		0.44
Snacks		0.43
Poultry	0.17	0.42
Refined grains		0.41
Eggs	0.21	0.36
Sweets and desserts		0.29
Sugar, jam, marmalade and “dulce de leche”		0.29
High-fat dairy products	0.12	0.27
Organic meat		0.24
Variance explained	10.3%	7.4%

Table 2. General characteristics of subjects according to quartiles of dietary pattern scores

Quartiles	Prudent pattern					Western-like pattern				
	Q1	Q2	Q3	Q4	p	Q1	Q2	Q3	Q4	p
MEN (n 429)										
Age (years)	51.9	53.4	52.6	55.2	0.057	54.8	54.7	51.8	51.4	0.004
Educational level (years)	8.7	10.3	10.7	10.1	0.004	10.0	10.3	10.0	9.8	0.715
Low physical activity%	44.4	56.6	57.9	49.1	0.154	51.4	53.2	53.7	49.5	0.923
Smokers %										
Never	29.2	36.1	42.0	37.1		35.5	41.1	34.9	32.6	
Current	41.5	40.9	28.0	30.4		29.8	29.4	41.5	40.3	
Former	29.2	22.8	30.0	32.3	0.204	34.6	29.4	23.5	26.9	0.295
Obesity%	25.9	25.2	30.8	33.6	0.297	34.2	28.9	22.4	29.9	0.271
Diabetes %	10.1	8.4	7.4	14.0	0.396	14.8	12.1	5.6	7.4	0.095
Hypertension %	38.8	40.1	41.1	52.8	0.144	43.5	45.7	37.7	45.7	0.597
WOMEN (n 542)										
Age (years)	52.6	51.1	52.6	53.5	0.333	54.4	52.5	51.8	51.0	0.008
Educational level (years)	9.5	10.1	9.7	10.1	0.434	9.6	9.9	10.0	9.5	0.905
Low physical activity%										
Smokers %										
Never	49.6	56.7	55.9	56.0		61.1	60.6	47.7	48.8	
Current	37.5	29.1	23.1	21.9		20.9	26.5	29.1	35.3	
Former	12.7	14.1	20.9	21.9	0.042	17.9	12.8	23.1	15.7	0.038
Obesity%	36.0	37.7	33.8	38.5	0.162	34.5	34.1	40.4	37.0	0.077
Diabetes %	6.72	8.2	8.96	6.82	0.877	11.3	9.0	5.2	5.2	0.162
Hypertension %	37.5	36.3	44.8	35.8	0.384	38.2	47.0	35.2	34.0	0.122

Table 3. Mean biomarkers values, linear regression analysis (β coefficient) by quartiles of dietary pattern scores and gender

a-WOMEN	Prudent pattern					Western-like pattern				
	Q1	Q2	Q3	Q4	p	Q1	Q2	Q3	Q4	p
Apo B										
Mean (mg/l)	89.1	84.2	83.1	85.2		84.2	87.5	83.5	86.3	
Adjusted β	Ref	-5.4	8.3	-6.6	0.040	Ref	4.5	.7	5.7	0.372
Apo A-I										
Mean (mg/l)	125.9	122.7	125.5	124.1		125.1	124.3	124.9	123.6	
Adjusted β	Ref	-3.0	-.1	-2.7	0.597	Ref	-2.6	-3.4	-7.0	0.130
Cholesterol										
Mean (mg/dL)	217.6	205.1	204.6	208.9		207.0	212.5	205.8	210.9	
Adjusted β	Ref	-12.6	-14.9	-12.5	0.010	Ref	7.9	1.2	9.2	0.476
LDL-c										
Mean (mg/dL)	138.6	138.6	129.7	131.2		131.1	134.6	128.8	135.1	
Adjusted β	Ref	-8.7	-10.0	-9.7	0.018	Ref	.2	-.0	.3	0.488
Triglycerides										
Mean (mg/dL)	144.2	134.1	122.4	134.0		128.9	140.2	138.3	127.4	
Adjusted β	Ref	-14.1	-23.9	-17.6	0.028	Ref	11.2	9.4	-1.4	0.094
HDL-c										
Mean (mg/dL)	50.6	47.5	50.8	51.1		50.6	49.6	49.6	50.5	
Adjusted β	Ref	-2.6	.5	.1	0.419	Ref	-2.1	-3.1	-3.8	0.128
CRP										
Mean (mg/L)	3.9	4.0	3.6	3.4		3.7	3.7	4.2	3.2	
Adjusted β	Ref	-.2	-.5	-.7	0.263	Ref	.2	.8	.4	0.562

b-MEN	Prudent pattern					Western-like pattern				
	Q1	Q2	Q3	Q4	p	Q1	Q2	Q3	Q4	p
Apo B										
Mean (mg/l)	90.9	86.9	87.8	84.3		88.6	87.7	87.3	87.8	
Adjusted β	Ref	-1.3	-3.4	-8.2	0.017	Ref	-.1	.3	.3	0.907
Apo A-I										
Mean (mg/l)	111.4	106.7	109.9	109.0		111.4	109.6	106.4	110.1	
Adjusted β	Ref	-2.7	.01	-2.7	0.212	Ref	-2.6	.01	-2.7	0.356
Cholesterol										
Mean (mg/dl)	209.4	206.4	205.8	193.9		202.7	206.1	201.8	204.9	
Adjusted β	Ref	-1.4	-1.8	-14.8	0.012	Ref	3.0	-.7	2.1	0.959
LDL-c										
Mean (mg/dl)	137.9	128.3	130.7	120.0		129.4	129.0	130.6	131.7	
Adjusted β	Ref	-.7	-3.9	-19.0	0.009	Ref	1.0	4.4	8.1	0.324
Triglycerides										
Mean (mg/dl)	158.0	176.8	204.6	177.2		177.4	184.6	176.4	178.2	
Adjusted β	Ref	19.3	38.4	11.3	0.553	Ref	19.6	4.3	6.5	0.353
HDL-c										
Mean (mg/dl)	42.7	40.7	41.4	39.4		42.1	42.1	39.6	41.3	
Adjusted β	Ref	-.7	.2	-2.2	0.244	Ref	-1.3	-2.8	-1.4	0.531
CRP-normal weight										
Mean (mg/L)	3.7	4.7	1.4	2.4		3.4	2.1	3.6	3.8	
Adjusted β	Ref	.7	-2.2	-1.1	0.045	Ref	-.9	.73	.94	0.772
CRP-overweight										
Mean (mg/L)	2.5	3.6	2.8	3.6		1.8	3.6	3.3	4.1	
Adjusted β	Ref	.7	.1	.2	0.192	Ref	1.4	.7	1.1	0.769
CRP-obese										
Mean (mg/L)	5.9	4.1	5.4	4.3		4.3	3.1	5.4	7.0	
Adjusted β	Ref	-4.2	-3.2	-3.8	0.247	Ref	-.9	.7	2.4	0.394

Conclusions: Prudent dietary pattern was associated with a healthier lipid profile in both genders, especially with total and LDL cholesterol and Apo B. The prudent pattern was also associated with a better inflammatory profile in normal weight men. Apolipoprotein A1 as well as HDL-c did not show any relationship with diet in our population.