

# Cardiovascular risk factors and proteinuria in Toba aborigines from Chaco, Argentina

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The Province of Chaco (Argentina) was part of the 'Great Chaco', a geographical region of area 300,000 km<sup>2</sup>, which comprised the North East of Argentina, the South East of Paraguay, and Bolivia. Since ancient times, the region has been inhabited by aborigine ethnic groups. At present, aborigines constitute 4.8% of the Province inhabitants. Originally gatherers and hunters, during the last century they have been absorbed into Western civilization. In 2006, in a cross-sectional study of a random sample of the 365 Toba urban individuals, of mean age 36 years, a high prevalence of cardiovascular (CV) risk factors was found: hypertension (HT) 25%, central obesity 49.5%, overweight 33.5%, and obesity 21.3%. Proteinuria was present in 21.8% of the population, measured by urine protein (mg)/urine creatinine (mg) ratio; the values ranged between 0.20–0.49 in 67 individuals (80%), 0.50–1.00 in 10 (12%), and greater than 1.00 in 7 (8%). Only in 5.5% was the estimated glomerular filtration rate <60 ml/min. The relative risk for proteinuria for ages between 45–64 years was 3.84 (95% confidence interval 2.04–7.23) after adjusting for CV risk factors and gender. Follow-up of the 2006 cohort during 37 months showed an increase in the prevalence of CV risk factors: HT rose to 33% (only 5% of the previously known hypertensive group having control of their blood pressure); obesity reached 25%. The global mortality rate was 36/1000. The principal causes were infection and CV diseases. Toba aborigines are a vulnerable community with a high prevalence of risk CV apparently linked to the adoption of a Western lifestyle.

*Kidney International Supplements* (2013) **3**, 206–209; doi:10.1038/kisup.2013.15

KEYWORDS: cardiovascular risk factors; proteinuria; Toba aborigines

## INTRODUCTION

Up until 1875, the current Province of Chaco (Argentina) was part of the 'Gran Chaco' (Great Chaco), a huge geographical region of about 300,000 km<sup>2</sup>, which extends from the North East of Argentina to the South East of Paraguay and Bolivia.

Since ancient times, this region has been inhabited by several aborigine ethnic groups belonging to two linguistic families: the Guaycurú (Abipones, Mocovies, Toba, and Pilagaes) and the Matacco Maccá (Matacos or Wichis and Chorotis).<sup>1</sup> Although these people were originally hunters and gatherers, recurrent local socioeconomic policies forced them to migrate mostly to the cities, where they currently survive by finding temporary work. Having had contact with Western civilization for almost a century, these groups show significant lifestyle changes due to the necessary process of cultural assimilation that they have endured.<sup>2</sup>

In this Province, the exact number of aborigine people is not officially known. Data from the 2010 census are still pending. The first National Aborigine Census was published in 1968 (ref. 3). In 1992, a report from the Provincial Ministry of Social Welfare estimated that between 45,000 and 60,000 Toba aborigines were living in the Province.<sup>4</sup> More recently, in 2004–2005, data from the Complementary Survey of Indigenous People estimated that 47,591 Toba aborigines were living in three Argentine provinces (Chaco, Formosa, and Corrientes).<sup>5</sup> In 2010, the Economic Commission of Latin America and the Caribbean (ECLAC) report on 'Socio demographic diagnosis of indigenous people in Argentina' established that indigenous people made up 4.8% of the population of the Province of Chaco.<sup>6</sup> The distribution in the provincial territory is not homogeneous; in some counties aborigines outnumber the Caucasians.

The Province is one of the poorest in the country. Life expectancy at birth, in the year 2000, was 65.6 years for men and 72.6 for women, both figures below the national average of 68.4 and 75.6, respectively. The infant mortality rate was as high as 27.7/1000 in 2003, and it was still very high (18.9/1000) in 2006. Thirty-three percent of the population lives with one or more indicators of unsatisfied basic needs. At present, the province has the highest teenage pregnancy rate in the country.<sup>7</sup>

Although the aborigine population was the only one inhabiting Chaco up until the end of the nineteenth century,

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no research has been carried out with the aim of studying the differences that might exist between this ethnic group and the Caucasian population.

### CARDIOVASCULAR AND RENAL RISK FACTORS IN THE TOBA POPULATION, AND PREVALENCE OF PROTEINURIA

In 2006, in a cross-sectional study in a random sample of 385 individuals of the Toba urban population with an average age

of 36 years, there was a high prevalence of cardiovascular risk factors (CVRF), including hypertension (HT) 25% (95% confidence interval (CI) 20.9–29.8); central obesity 49.5% (95% CI 44.3–54.5); and overweight 33.5% (95% CI 28.5–38.5). The prevalence of proteinuria, measured by urine protein (mg)/urine creatinine (mg) ratio, was 21.8% (95% CI 17.8–26.3) (Table 1);<sup>8</sup> the values ranged between 0.20–0.49 in 67 individuals (80%); 0.50–1.00 in 10 (12%); and > 1.00 in 7 (8%). The estimated glomerular filtration rate (eGFR) was between 30 and 60 ml/min in 5.5% of the subjects (Table 2).

From these findings, it seems that this group of aborigine people features a young population with high prevalence of CVRF. The significance of proteinuria, a marker of kidney disease, in this population is yet to be determined.

Based on these results, a number of lines of research/action were designed. With the objective of promoting awareness and prevention, the researchers organized meetings with the Toba people in their own neighborhoods in order to identify the natural community leaders, who were then trained to detect the risk factors; those people identified with CVRF and/or proteinuria were referred for medical care.

As this ethnic group has a language with no written tradition, there were no equivalent words for HT, diabetes, kidney failure, or myocardial infarction.<sup>4</sup> Therefore, at the meetings neologisms had to be created to refer to them. All the work has been done within an ethical framework which respects their culture, with their written consent translated into their language.

**Table 1 | Subject characteristics (number in study = 385)**

	N	%
Male	139	36.1
Female	246	63.9
Diabetes	8	2.1
Hypertension	97	25.2
<i>BMI</i>		
<20	32	8.3
20–<25	142	36.9
25–<30	129	33.5
≥30	82	21.3
Central obesity	190	49.4
Proteinuria	84	21.8
CKD	93	24.2
Stage 3	21	5.5
	Mean ± s.d.	Range
Age (years)	36.1 ± 16.5	14–91
BMI (kg/m <sup>2</sup> )	26.5 ± 5.5	15.2–46.9

**Table 2 | CVD risk factor prevalence (95% confidence interval) according to age and gender<sup>8</sup>**

	N	Diabetes	Arterial hypertension	Obesity	Central obesity	Proteinuria	CKD
Women	246	2.4 (0.9–4.4)	23.6 (18.4–29.4)	32.1 (26.3–38.3)	63.4 (57.1–69.4)	23.2 (18.1–29.0)	25.6 (20.3–31.5)
<25 years	73	0	0	28.7 (18.8–40.6)	35.6 (24.8–47.7)	11.0 (4.9–20.5)	11.0 (4.9–20.5)
25–44 years	110	0.9 (0.0–5.0)	19.1 (12.2–27.7)	33.6 (24.9–43.3)	66.4 (56.7–75.1)	16.4 (10.0–24.6)	17.3 (10.7–25.7)
45–64 years	43	7.0 (1.5–19.1)	51.1 (35.5–66.7)	39.5 (25.0–55.6)	88.4 (74.9–96.1)	53.5 (37.7–68.8)	55.8 (39.9–70.9)
≥65 years	20	10.0 (1.2–37.7)	75.0 (50.9–91.3)	20.0 (5.7–43.7)	95.0 (75.1–99.9)	40.0 (19.1–64.0)	60.0 (36.1–80.9)
Men	139	1.4 (0.2–5.1)	28.1 (20.8–36.3)	36.0 (28.0–44.5)	24.5 (17.6–32.5)	19.4 (13.2–27.0)	21.6 (15.1–29.4)
<25 years	36	0	2.8 (0.1–14.5)	13.9 (4.7–29.5)	2.8 (0.1–14.5)	13.9 (4.7–29.5)	13.9 (4.7–29.5)
25–44 years	59	0	23.7 (13.6–36.6)	42.4 (29.6–55.9)	27.1 (16.4–40.3)	8.5 (2.8–18.7)	8.5 (2.8–18.7)
45–64 years	35	5.7 (0.7–19.2)	48.6 (31.4–66.0)	45.7 (28.8–63.4)	45.7 (28.8–63.4)	37.1 (21.5–55.1)	42.9 (26.3–60.7)
≥65 years	9	0	77.8 (40.0–97.2)	44.4 (13.7–78.8)	11.1 (0.3–48.3)	44.4 (13.7–78.8)	55.6 (21.2–86.3)
All	385	2.1 (0.9–4.1)	25.2 (20.9–29.8)	33.5 (28.8–38.5)	49.4 (44.3–54.5)	21.8 (17.8–26.3)	24.2 (20.0–28.8)
<25 years	109	0	0.9 (0.0–5.0)	23.9 (16.2–33.0)	24.8 (17.0–34.0)	11.9 (6.5–19.5)	11.9 (6.5–19.5)
25–44 years	169	0.6 (0.0–3.3)	20.7 (14.9–27.6)	36.7 (29.4–44.4)	52.7 (44.9–60.4)	13.6 (8.8–19.7)	14.2 (9.3–20.4)
45–64 years	78	6.4 (2.1–14.3)	50.0 (38.5–61.5)	42.3 (31.2–54.0)	69.2 (57.8–79.2)	46.2 (34.8–57.8)	50.0 (38.5–61.5)
≥65 years	29	6.9 (0.9–22.8)	75.9 (56.5–89.7)	27.6 (12.7–47.2)	69.0 (49.2–84.7)	41.4 (23.5–61.6)	58.6 (38.9–76.5)
<i>CKD</i>							
No	292	0.3 (0.0–1.9)	18.2 (13.9–23.1)	33.9 (28.5–39.7)	45.6 (39.7–51.5)	0	
Yes	93	7.5 (3.1–14.9)	47.3 (36.9–57.9)	32.3 (22.9–42.8)	61.3 (50.6–71.2)	90.3 (82.4–95.5)	
Stage 1	26	3.9 (0.1–19.6)	15.4 (4.4–34.9)	23.1 (9.0–43.7)	30.8 (14.3–51.8)	100	
Stage 2	46	8.7 (2.4–20.8)	52.2 (37.0–67.1)	37.0 (23.2–52.5)	73.9 (58.9–85.7)	100	
Stage 3	21	9.5 (1.2–30.4)	76.2 (52.8–91.8)	33.3 (14.6–57.0)	71.4 (47.8–88.7)	57.1 (34.0–78.2)	

Abbreviations: CKD, chronic kidney disease; CVD, cardiovascular disease.

Statistical significance:

Age trends: all  $P < 0.01$  except obesity for females ( $P = 0.80$ ) and DM2 for males ( $P = 0.15$ ), using Cochran–Armitage test for trend.

Gender: No significant differences ( $P > 0.20$ ) except central obesity, with  $P < 0.0001$ , using Fisher's exact test.

CKD: all  $P < 0.01$  for Yes/No (Fisher's exact test) and for trend over stages (Cochran–Armitage test) except obesity ( $P > 0.80$ ).

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At 2%, the prevalence of diabetes mellitus (DM) was lower than expected in the aboriginal population as a whole. However, in Corrientes City, which is adjacent to Resistencia, the prevalence of DM was 19% in the obese aboriginal population and 7% in the nonobese.<sup>9</sup> Also, the 2009 Argentinean Risk Factors National Survey (which does not differentiate between ethnic groups) showed a prevalence of 9.6% (95% CI 9.1–10.1) for Chaco Province.<sup>10</sup> This lower prevalence may be due to the younger age of our population.

The same sampled population of Toba aborigines studied in 2006 constituted a cohort that was followed by the trained aborigine health agents. In 2009, after 37 months of follow-up, the prevalence of cardiovascular disease was 33%, with an incidence of new hypertensive patients of 9%. Only 5% of the previously known hypertensive group had achieved control of their blood pressure (BP).<sup>11</sup>

Sixty-two hypertensive aborigines detected in 2003 were followed and treated, 69% with diet alone and 31% with the use of drugs. Out of 3154 determinations of BP, made during 3 years, control (<130/90 mm Hg) was achieved in 84% of the group on diet alone as compared with 54% of the patients who required the use of drugs ( $P < 0.005$ ).<sup>12</sup> As was described for Hispanics and Mexican Americans living in the United States, the reasons for racial and ethnic differences in BP control may include factors such as lack of access to health care, low socioeconomic status, language barriers, degree of acculturation, poor doctor/patient communication, and genetic factors.<sup>13</sup>

The proportion of obese people is rising quickly in this population. After a mean follow-up of 37 months, obesity rose from 21 to 25%.<sup>14</sup> Similar results have been obtained in studies in other ethnic groups in the region, probably linked to the nutritional transition that these groups are experiencing.<sup>15</sup>

The eating habits of the Toba community have been studied and it is clear that there is no trace of the hunter-gatherer society. The diet is now based on carbohydrates and fat; only 5% of the population drink milk or eat milk products, 12.5% drink soft beverages, and only 3.2% eat fruit every day. Besides that, 19.2% acknowledge daily alcohol intake. The same study shows that 50.9% of the population is sedentary, especially those living in cities (60.3%) compared to those living in rural areas (44%).<sup>16</sup> These populations did not use sodium chloride until the nineteenth century, when white people arrived. Up until then, they used to flavor food with ashes of a plant called 'tohue'.<sup>17</sup> To promote awareness about the amount of added sodium in food and determine the real salt consumption, a study was performed, with the community referents; salt containers were weighed before, and in two consecutive days at the homes the mean daily consumption of salt per person was 19 g per day, higher than the estimated mean of about 12 g per day in Argentina.<sup>18,19</sup>

Regarding the presence of proteinuria, this marker has not been studied in larger samples. The most important finding of this study was that the proteinuria was not associated with deterioration in the eGFR, nor was the presence of DM or

**Table 3 | Adjusted relative risk of proteinuria for CVRF**

Risk factor	Adjusted <sup>a</sup> RR	95% CI for RR	P-value
Female	1.37	0.89–2.11	0.15
Hypertension	1.46	0.97–2.20	0.07
Obesity	0.75	0.51–1.09	0.13
Central obesity	0.84	0.53–1.33	0.46
Age <sup>b</sup> (years)			
25–44	1.14	0.60–2.19	0.69
45–64	3.84	2.04–7.23	<0.0001
≥65	2.79	1.30–5.97	0.008

Abbreviations: CVRF, cardiovascular risk factors; RR, relative risk.

<sup>a</sup>Adjusted mutually for other factors in this table.

<sup>b</sup>Relative to age <25 years.

HT. As shown in Table 3, the relative risk of proteinuria, after adjusting for CVRF and sex, was 3.84 for the age group 45–64 years (95% CI 2.04–7.23).

In 1998, Hoy *et al.*<sup>20</sup> showed the multidimensional factors that converge in the development of proteinuria in Australian Aborigines, and more recently, the DRUID study showed that albuminuria in the Australian aborigines is not associated with a low eGFR,<sup>21</sup> similar to our results.

Mortality rate in the 2006 study cohort was 11.4 per thousand person years, or, expressed as a crude mortality rate, 36% in 37 months. The causes of death included tuberculosis (45%), cardiovascular causes (38%; mainly stroke), cancer (8%), and domestic accidents (7%).<sup>22</sup>

#### END-STAGE RENAL DISEASE IN CHACO

The Argentine Dialysis Registry states that the average age of patients starting dialysis in 2008 was 59.8 years, and patients older than 65 years represented almost half of them.<sup>23</sup> ECLAC's report points out that the elderly aborigine population (defined as older than 60) is small, probably reflecting a high early mortality (over a lifetime).<sup>6</sup> These references lead us to conclude that early mortality in this group of Toba aborigines might preclude them from developing end-stage renal disease (ESRD).<sup>24</sup>

As far as deceased organ donation and renal transplantation are concerned in the Province of Chaco, there are no registry data identifying patients as belonging to a specific ethnic group. The rate of deceased donors is currently 10.51 patients per million population (pmp) compared with a national average of 15 pmp.<sup>25</sup>

Dialysis services are covered by state insurance, and the prevalence of patients on dialysis in the 2008 National Registry in Chaco Province was 444.8 (pmp), lower than the national rate of 623.4 pmp.<sup>24</sup> This prevalence in the province of Chaco is similar to that observed in other countries in Latin America with a low gross domestic product.<sup>25</sup>

#### CONCLUSION

The high level of cardiorenal risk factors in this aboriginal population, living in a poverty-stricken framework and in a transculturalization process, makes them extremely vulnerable. A high prevalence of risk factors, such as central obesity,

sedentary habits, and change in food habits, associated with the change to a Western life style, was encountered in this population. Causes of death were mainly stroke and infectious disease. A high prevalence of proteinuria was found, but not ESRD, probably because of premature death from other causes.

Analyzing these results in this population, from an anthropological point of view, one sees the evolution of a population from hunters and gatherers to living according to free market laws, in urban settings, immersed in the process of nutritional and epidemiological transition, characterized by an increase in chronic noncommunicable disease, while the fight continues against acute and chronic infections. The consequences are evident, showing a high prevalence of risk factors associated with the change into a Western lifestyle, including obesity, sedentary habits, high BP, and mortality caused by stroke and infectious diseases.

## DISCLOSURE

All the authors declared no competing interests.

## ACKNOWLEDGMENTS

Publication of this article was supported in part by the National Health and Medical Research Council of Australia through an Australia Fellowship Award (#511081: theme Chronic Disease in High Risk Populations) to Dr Wendy Hoy, School of Medicine, the University of Queensland, and the National Institutes of Health—NIDDK DK079709, NCR R026138, and NIMHD MD000182.

## REFERENCES

1. Republic of Argentina. *Statistics and Census of the Province of Chaco. Demographic Situation of the Province of Chaco*. INDEC: Buenos Aires, Argentina, 2000, pp 3–4. ISBN 950-896-248-8 (in Spanish).
2. Mendoza M. Adaptative strategies of Toba Indian migrants in the greater Buenos Aires. *Acta Psiquiatr Psicol Am Lat* 1989; **35**: 139–144.
3. Ministry of Interior. Secretary of State of Government. National Indigenous Census. Buenos Aires, 1967–68. Available printed version at National Institute of Anthropology and Latin American thought (ed. 3 de Febrero 1378-C1426BJN) 1378. Ciudad de Buenos Aires: República Argentina (in Spanish).
4. Censabella M. *Indigenous Languages of Argentina*. EUDEBA: Buenos Aires, Argentina, 1999 pp 65–67 (in Spanish).
5. National Institute of Statistics and Census of Argentina INDEC 2011. Available at [http://www.indec.gov.ar/principal.asp?id\\_tema=65](http://www.indec.gov.ar/principal.asp?id_tema=65) (cited November 2006).
6. Ribotta B. *Economic Commission for Latin America and the Caribbean (ECLAC)*. Fundación Ford, 2010. Available at: [http://www.eclac.cl/celade/noticias/paginas/7/40377/Argentina\\_julio2010.pdf](http://www.eclac.cl/celade/noticias/paginas/7/40377/Argentina_julio2010.pdf) (cited October 2010).
7. National Institute of Statistics and Census of Argentina (INDEC) 2010 Available at [http://www.indec.gov.ar/webcenso/ECPI/index\\_ecpi.asp](http://www.indec.gov.ar/webcenso/ECPI/index_ecpi.asp) (cited November 2006).
8. Bianchi ME, Fariás E, Bolaño J. Epidemiology of renal and cardiovascular risk factors in Toba Aborigines. *Renal Failure* 2006; **28**: 665–670.
9. Vallejos JA, Rasmussen R, Brisuela M et al. Obesity and cardiovascular co morbidities. Results of the first phase of the survey on the prevalence of coronary risk factors in Corrientes. *Rev Fed Arg Cardiol* 2003; **32**: 199–208.
10. Public Health Ministry of Argentina. *Second National Survey of Risk Factors 2011* (in Spanish). Available at <http://www.bvs.org.ar/pdf/enfr2009.pdf> (cited September 2011).
11. Bianchi ME, Young M, Toledo F et al. Increased prevalence of hypertension in a cohort of Toba Indians of Chaco Province of Argentina, 2003–2007. *Nefrol Argentina* 2007; **2**: 170 (in Spanish).
12. Bianchi ME, Toledo, Caceres Narizzano O et al. Follow-up of hypertensive patients of ethnic Toba. *Nefrol Argentina* 2009; **7**: 178–179.
13. Ventura H, Piña IL, Lavie CJ. Hypertension and antihypertensive therapy in Hispanics and Mexican Americans living in the United States. *Postgrad Med* 2011; **123**: 46–57.
14. Bianchi ME, Toledo FA, Vallejos J. Changes of risk profile in a cohort of Toba aborigines from Chaco, Argentina (abstract). Renal disease in ethnic minorities and development countries. Petropolis, Brazil 2007.
15. Valeggia CR, Burke KM, Fernandez-Duque E. Nutritional status and socioeconomic change among Toba and Wichí populations of the Argentinean Chaco. *Econ Hum Biol* 2010; **8**: 100–110.
16. Ventura A. Dietary habits and sedentary indigenous population of Chaco Argentina. *Thesis*, Cuenca del Plata University. Available at <http://www.fundacionrenal.org.ar/archivos/TESINA%20FINAL%20-%20VENTURA%20ANDREA%20-%20UCP%20-%20LIC.%20EN%20NUTRICION.pdf> (cited September 2011).
17. Arenas P. *Ethnography and Food among the Toba-Nachilamole # ek and Wichí-Lhuku'tas Central Chaco (Argentina)*. Latin Grafica SRL: Buenos Aires, Argentina, 2003 (in Spanish).
18. Cusumano AM, Ojeda C, Ojeda O et al. Sodium added to foods in a random sample of homes of Toba ethnica of Resistencia, Chaco (abstract). *I Conference on Kidney Disease in Disadvantaged Populations of the Southern Cone of Latin America*; 8–10 April 2010; Resistencia, Chaco (in Spanish).
19. Legetic B, Campbell N. Reducing salt intake in the Americas: Pan American Health Organization actions. *J Health Commun* 2011; **16**(Suppl 2): 37–48.
20. Hoy WE, Mathews JD, Mccredie DA et al. The multidimensional nature of renal disease: rates and associations of albuminuria in an Australian Aboriginal community. *Kidney Int* 1998; **54**: 1296–1304.
21. Maple-Brown LJ, Cunningham J, Hodge A et al. High rates of albuminuria but not of low eGFR in urban indigenous Australians: the DRUID Study. *BMC Public Health* 2011; **11**: 346.
22. Bianchi ME, Caceres Narizzano O, Cabral AL et al. Aboriginal mortality. *J Faculty Med UNNE* 2010; **31**: 15–21 (in Spanish).
23. Marinovich S, Lavorato C, Celia E et al. Argentine Registry of Chronic Dialysis 2008. Inform 2010. *Nefrol Argentina* 2011; **9**(Suppl 1): S45–S47.
24. Central Unique National Institute Coordinator of Ablation and Implant Deceased donors. INCUCAI, 2011. Available at <http://www.incucai.gov.ar/home.do> (cited October 2011).
25. Caskey FJ, Kramer A, Elliott RF et al. Global variation in renal replacement therapy for end-stage renal disease. *Nephrol Dial Transplant* 2011; **26**: 2604–2610.