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AGING AND SEXUAL DIMORPHISM IN ABORIGINES FROM CHUBUT (ARGENTINA)

ABSTRACT: The aim of this work was to assess the morphological variation and sexual dimorphism associated to aging processes in the Tehuelche community of El Chalía (Chubut, Argentina). A cross-sectional anthropometric study was carried on forty-three individuals of both sexes, divided by age groups: adults (from 20 to 60 years old) and seniles (from 61 to 80 years old). Data were processed by Multifactor analysis of variance (ANOVA) and post-hoc LSD (multiple range tests). Z scores were calculated using US standards as the reference. Senile aborigines showed lower values in most of variables compared to adults. Sexual dimorphism was evident in almost all the variables. Skinfolds and fat area showed the greatest sexual differences, females being greater than males. Since historical Tehuelche aborigines are known to be the tallest South-American Indians, the short stature found in the current population may be associated to negative secular changes and the poor quality of living conditions.

KEY WORDS: Aborigines – Aging – Sexual dimorphism

INTRODUCTION

There are a few longitudinal and cross-sectional studies about developmental changes after the age of 18, despite growth may continue for as much as a further decade (Garn 1980). Most of the age-related studies were made by forensic anthropologists and human biologists interested in morphological traits alterations (i.e. Forbes, Reina 1970, Sussane 1967).

The studies on sexual differentiation have been restricted on the puberty changes. However, Kiebzak (1991) reported quantitative and qualitative bone changes between sexes in adults and Chandler and Bock (1991) related those processes to the age after 40 years. According to Pucciarelli *et al.* (2001), the adult sexual dimorphism might be associated to catabolic mechanisms linked to aging in females.

There is scarce information about aging in aboriginal populations, particularly in Argentina. The modern Tehuelches are remnants of a formerly quite large tribe that, in historic times, spread in Patagonia (Cloux 1988, Oyhenart *et al.* 2000). Some degree of intermixture with non-aboriginal populations has occurred over the past years (Valory 1968). Nevertheless, Escalada (1949) and Onelli (1977) stated that Tehuelches are one of the more isolated groups from White populations. Accordingly, recent studies reported relatively low levels of interethnic admixture (Goicoechea *et al.* 2001).

The aim of the present study was to evaluate the morphological variation and sexual dimorphism associated to aging processes in a Tehuelche community of El Chalía (Chubut, Argentina).

MATERIALS AND METHODS

At the time of the study, the population of El Chalía was composed of 102 individuals, mainly adults (Rosetti 1994). A cross-sectional study was carried out on forty-three individuals distributed in two age groups: adults (12 males and 12 females, from 20 to 60 years of age) and seniles (12 males and 7 females, from 61 to 80 years of age). Like other studies on indigenous populations (Bogin *et al.* 1992, Eveleth *et al*. 1974), the small sample size does not invalidate the highly descriptive value, as it comprises almost the whole of the adult-senile population (80%). The following variables were measured: body weight (lever scale ±100g precision); standing height, (anthropometer, 1mm of precision); sitting height, between the seating surface and the Vertex (anthropometer and anthropometric stool of 50 cm height); upper-arm circumference*,* at the left arm midway (measuring steel tape, 1mm of precision); elbow breadth*,* maximum bicondylar width of the humerus (sliding caliper, 1 mm of precision); triceps skinfold*,* on the left arm, at the same level as the upper-arm circumference (Lange caliper, 1 mm of precision); subscapular skinfold*,* measured at 15–20 mm below the left scapula (Lange caliper, 1 mm of precision). Body mass and sitting height indexes (see Frisancho 1993), and upper arm muscle and fat areas (see Bolzán *et al.* 1999) were calculated.

The goodness of fit for the frequency distributions was evaluated by the Kolmogorov-Smirnov test. Z scores were estimated, according to the US standards (Frisancho 1993). Multifactor ANOVA tests were applied on standardized data and in significant cases, post-hoc comparisons (LSD tests). The relative sex variation was calculated by Percent Differences between Means (PDM) (see Oyhenart *et al.* 2000). The statistical work was performed using the SYSTAT 7.0 package.

TABLE 1. Test of Kolmogorov-Smirnov for one sample.

Variable	z
Body weight	0.81 ns
Standing height	0.67 ns
Sitting height	0.44 ns
Upper arm circumference	0.69 ns
Elbow breadth	0.77 ns
Triceps skinfold	0.86 ns
Subscapular skinfold	1.14 ns
Body mass index	1.02 ns
Upper arm muscle area	0.73 ns
Upper arm fat area	1.15 ns

ns: non-significant

RESULTS

Data distributions did not diverge from normal values (*Table 1*). Mean and standard deviations are listed in *Table 2*. Significant differences in function of age were

TABLE 2. Mean and Standard Deviation (SD) values.

Variable	ADULT				SENILE			
	Males		Females		Males		Females	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Body weight (kg)	74.43	19.29	70.03	16.64	71.79	20.58	57.91	16.16
Standing height (mm)	1639.30	75.01	1495.1	77.47	1611.58	64.14	1474.4	67.68
Sitting height (mm)	867.08	46.89	798.75	29.91	848.42	33.99	780.71	38.43
Upper arm circumference (mm)	294.00	31.91	297.25	40.19	278.67	48.23	265.29	34.92
Elbow breadth (mm)	66.01	7.53	60.42	6.92	68.75	4.88	60.86	4.38
Triceps skinfold (mm)	13.83	9.17	26.01	6.47	10.58	6.41	19.29	9.69
Subscapular skinfold (mm)	15.42	5.57	25.51	9.32	13.51	5.95	17.86	10.73
Body mass index	27.58	6.11	31.36	7.26	27.39	6.48	26.45	6.04
Upper arm muscle area	50.16	6.79	37.56	9.28	48.86	15.02	33.56	5.74
Upper arm fat area	21.36	17.04	39.34	14.14	15.72	11.71	26.68	16.82

TABLE 3. Analysis of Variance (ANOVA).

Variable	Age	Sex	Interaction
Body weight	1.61 ns	2.48 ns	0.67 ns
Standing height	1.16 ns	39.21 **	0.03 ns
Sitting height	2.41 ns	33.04 **	0.01 ns
Upper arm circumference	3.59 ns	0.17 ns	0.44 ns
Elbow breadth	0.66 ns	11.78 ns	0.35 ns
Triceps skinfold	4.11 *	18.01 **	0.51 ns
Subscapular skinfold	3.82 ns	8.71 **	1.37 ns
Body mass index	1.55 ns	0.48 ns	1.32 ns
Upper arm muscle area	0.68 ns	18.71 **	0.18 ns
Upper arm fat area	3.87 ns	9.66 **	0.57 ns

* < p 0,05; ** <p 0,01; ns: non-significant

found only in tricipital skinfold, while sex showed significant differences for standing and sitting heights, triceps and subscapular skinfolds, upper-arm muscle and upper-arm fat areas. There was no interaction between factors (*Table 3*).

Sexual comparisons were significant in standing and sitting heights, tricipital skinfold, elbow breadth and upper arm muscle area in both age groups. Subscapular skinfold and upper arm fat area were significant only in adults (*Figure 1*).

Except standing height, z scores values were similar to the reference (*Figures 2* and *3*).

DISCUSSION

Many physiological phenomena evidence age-related changes and a high variation within and between populations (Harper, Crews 2000). Bailey (1991) and Garn (1994) reported that when we grow older, the general tendency is toward greater robusticity in body size and increased percentage of body fat until the late 60s, after that the percentage of body fat decreases. Concurrent with increasing amount of body fat, fat-free mass tends to decrease with age. Thus, muscles become weak and bones demineralize in many elderly adults (Anderson 1995, Forbes, Reina 1970, Goodpaster *et al.* 2001, Stini 1990, 1995). Such age-related changes were found between adults and senile Tehuelche individuals, being particularly evident in tricipital skinfold.

Antoszewska and Wolanski (1992) reported that differences between males and females increase with age, at least until adulthood. In accordance, in the present study most of dimensions were dimorphic. However, they did not follow the same pattern. Skinfold tissues and fat area showed the greatest sexual differences (females greater than males) followed by muscle and bone tissues (males greater than females). At variance, a reduced sexual dimorphism was found in body weight, which may be related to a greater bone and muscle and lesser fat mass in men than in women. In contraposition to the adolescence one, this late dimorphism appears to be a result of differentiation processes acting during the latest stages of the life cycle (Pucciarelli *et al.* 2001). Thus, sexual dimorphism in bone tissues could be explained because of the greater bone mass loss in women following menopause (Drinkwater 1994, Reeve *et al.* 1999).

FIGURE 1. Percent differences between means (%) for sexual comparisons. Whites: $p < 0.05$; hatches: $p < 0.01$; bw: body weigth; h: height; sh: sitting height; uac: upper arm circumference; eb: elbow breadth; ts: triceps skinfold; ss: subscapular skinfold; bmi: body mass index; uama: upper arm muscle area; uafa: upper arm fat area.

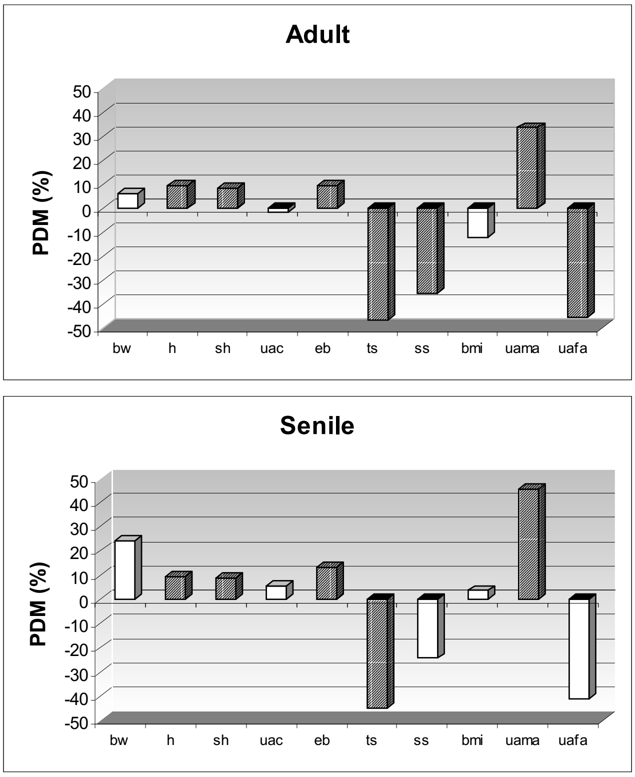


FIGURE 2. Mean z-scores for height (triangles), elbow breadth (circles), and sitting height index (crosses) in both sexes.

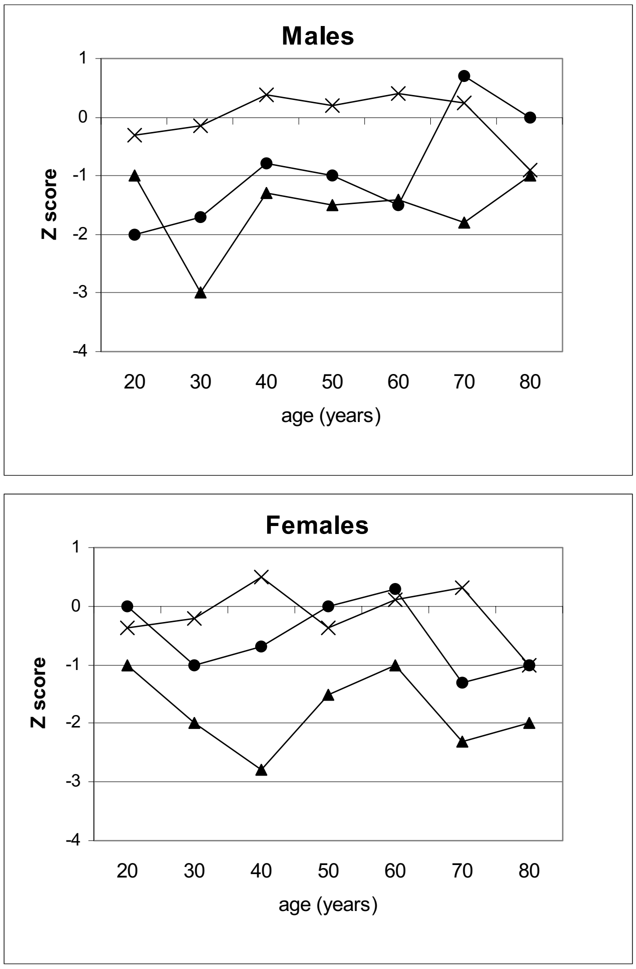
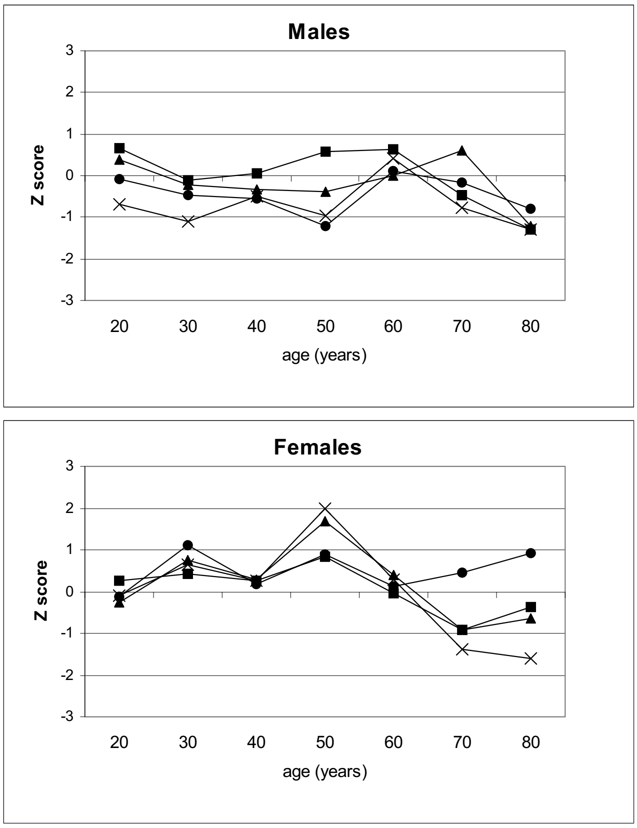


FIGURE 3. Mean z-scores for subscapular skinfold (triangles), fat area (squares), muscle area (circles), and body weight (crosses) in both sexes.



Although Tehuelche individuals were similar to the reference, stature remained below it. It is interesting to note that ancient Patagonian aboriginal populations were described as the tallest of South America (Johnston, Schell 1979, Stinson 1990). The earliest descriptions came from the first Europeans who established contact during the 16th century, and gave rise to the American myth of Patagonian gigantism (Pigafetta 1800). However, this information was never tested and it was probably biased towards the tallest individuals who impressed the Europeans (Hernández *et al.* 1998). Furthermore, during the 18th and 19th centuries, several ethnographical expeditions gave more accurate data (i.e. Falkner 1774, Lista 1894). Nevertheless, some methodological aspects, such as uncertain sample origin and the measurement techniques employed, made those descriptions of limited scientific application (Hernández *et al*. 1998). The most accurate height measurements in male skeletal remains seem to be between 174 and 190 cm (Hernández *et al.* 1998, Martinic 1995). Besides those data belonging to the southern continental populations, González *et al.* (1999) noted a strong homogeneity between pre-contact north and southern groups, explained by a common origin and/or genetic flow due to migration. Although comparisons between ethnographic-prehistoric evidence and the current Tehuelche population must be non-linear, a remarkable reduction of stature is observed. Reduced body size – from generation to generation – may be associated to a negative secular trend reflecting changes in the quality of the environment in which the individuals grew up (Tobias 1985, Wolanski 1985). A previous work on subadults in this population has found a significant reduction of sexual dimorphism (Oyhenart *et al.* 2000) supporting the hypothesis of a stressful environment (Stini 1969).

We conclude that the biology of Tehuelche population might be interpreted as a mirror of living conditions (Tanner 1986, Bogin, Keep 1999). The disarticulation and territorial retreat after the Conquest affected strongly the quality and lifestyle of these Amerindians.

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