Self-perceived health costs associated with a large **waist circumference** depend on **height.**

Self-reported Health is Related to Body Height and Waist Circumference in Rural Indigenous and Urbanised Latin-American Populations

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Background

- Human height is a costly, life-history component. Could be a sexually selected trait.
- The explanatory mechanisms that underlie this selection are poorly understood
- Extensive studies on the association between height and attractiveness, but the role of immunity in linking this relation is scarcely studied, particularly in non-Western (non-WEIRD) populations.

Methods

- In 477 participants (**Table** 1), we measured self-reported health (SF-36; validated for Colombia[1] and Mexico[2]), and relevant nutritional and health anthropometric indicators (measured thrice and averaged): body height (cm), waist circumference (cm), weight (kg), fat percentage, visceral fat level, muscle percentage and body mass index (BMI) **(Fig. 1**).

Results

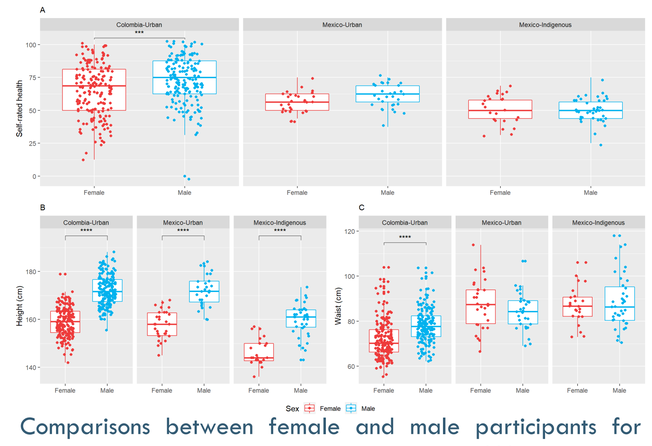
- Men report better health than women, Colombians report better health than Mexicans, and participants from urban samples report better health than indigenous participants (**Fig. 2**).
- Self-rated health is best predicted by an interaction between height and waist circumference: the costs associated with large waist circumference are height-dependent (**Table 2, Fig. 3**).

Conclusions

- Contrary to our initial hypothesis, height was not a significant predictor of self-perceived health but interacted with waist circumference in all populations studied.
- Most results in favour of a direct relationship between height and health were carried out in specific Western ethnic groups more than twenty years ago. New studies with non-traditional population groups have failed to verify the positive relationship between height and health, especially associated with cardiovascular and autoimmune diseases[3,4].
- Waist circumference predicted self-reported health differently for people of different heights: while being taller predicts better self-rated health for people with relatively small waists, being taller was found to be associated with poorer perceptions of health in people with larger waist circumferences. Furthermore, while there is a cost of abdominal and visceral adiposity for tall people, there is no predicted cost for shorter persons.
- These results argue the importance of considering a phenotypic integration of different human features that could be involved in health or physiological conditions, when a possible sexually selected trait is being evaluated as a signal of immunocompetence.

Figure 1. Distribution of all measured variables by sex, population and country.

Figure 2. Sexual differences in height, waist and health for all samples.



Comparisons between female and male participants for each sample,, adjusted for multiple tests. ***$p < 0.001$, ****$p < 0.0001$.

Table 1. Samples sizes.

Country	Sample	***n* = 477** 238W, 239M	Population
Colombia	Bogota	354 184W, 170M	Urban
Mexico	Mexico City	60 30W, 30M	
	Me'Phaa	63 24W, 39M	Indigenous

Table 2. Results of separate LMMs testing effects of independent variables on self-reported health.

Predictor	Model 1			Model 2			Model 3		
	Estimate	*df*	*p*	Estimate	*df*	*p*	Estimate	*df*	*p*
(Intercept)	-47.33	458.96	0.723	-205.97	466	0.057	**-223.02**	**466.91**	**0.036**
Age	0.13	424.47	0.444	0.15	382.15	0.37	.	.	.
BMI (kg/m²)	1.2	458.03	0.501	.	.	.	.	.	.
Fat (%)	-0.19	458	0.653	.	.	.	.	.	.
Height (cm)	0.73	458.79	0.392	**1.7**	**465.54**	**0.011**	**1.82**	**466.04**	**0.005**
Height:PopulationUrban	0.59	458.03	0.05	.	.	.	.	.	.
Height:SexMale	-0.25	458.23	0.258	.	.	.	.	.	.
Height:Waist	-0.01	458.62	0.479	**-0.02**	**465.54**	**0.02**	**-0.02**	**466.09**	**0.01**
Hip (cm)	-0.28	458.08	0.219	.	.	.	.	.	.
Muscle (%)	0.12	458.95	0.81	.	.	.	.	.	.
PopulationUrban	-83.95	458	0.073	**7.85**	**438.81**	**0.021**	**7.65**	**376.41**	**0.023**
SexMale	40.82	458.54	0.267	**6**	**465.02**	**0.008**	**5.87**	**466.04**	**0.01**
Waist (cm)	1.33	458.32	0.493	**2.94**	**465.38**	**0.034**	**3.23**	**466.29**	**0.017**
Weight (kg)	-0.32	458.09	0.622	.	.	.	.	.	.

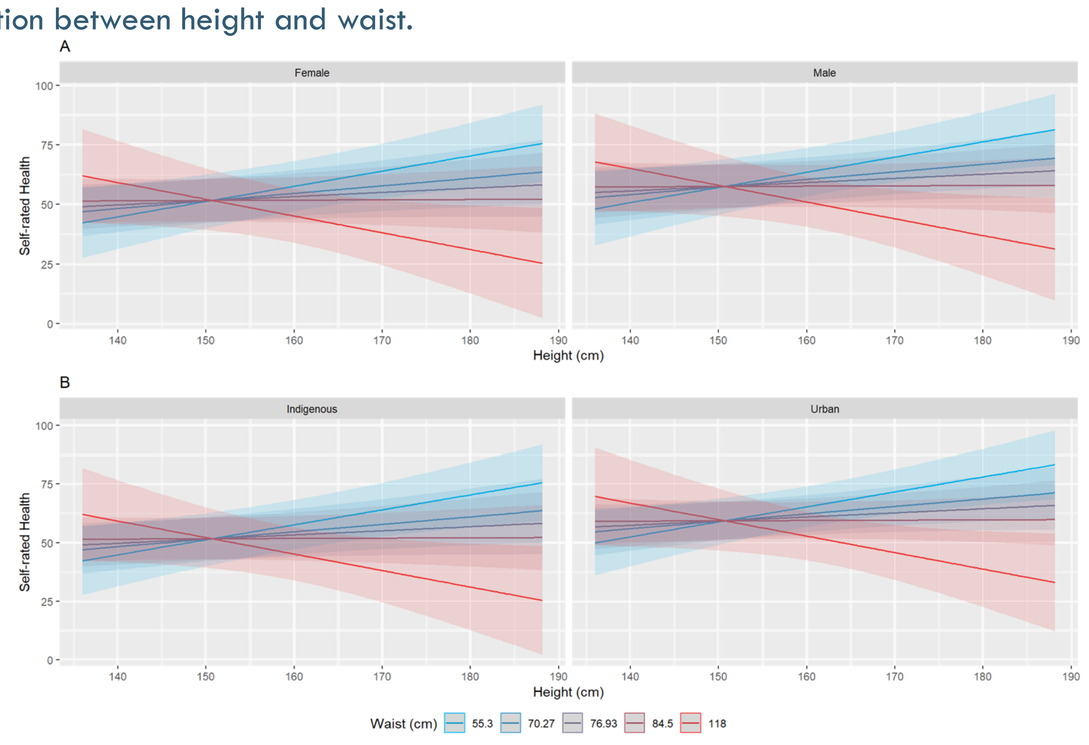
Table 3. Performance criteria of *LME* models.

	AIC	ΔAIC	*df*	w_i(AIC)
Model 3	4006.985	.	8	0.8185
Model 2	4010.019	3.0342	9	0.1795
Model 1	4019.03	12.0447	16	0.002

Indigenous population and females were used as reference for categorical predictors. Significant effects are in bold.

Figure 3. Interaction between height and waist.

Model predictions were split by sex (A), and population (B). As waist reference, minimum, quartiles (lower, median and upper), and maximum waist circumference values were used, showed on a blue to red colour scale.



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