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Body mass index and waist circumference of Latin American adult athletes with intellectual disability

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Abstract

Objectives. To examine both body mass index (BMI) status and waist circunference (WC) in a large international sample of adult Special Olympics participants from Latin America. It also explored the association of age and sex with obesity in this population. **Materials and methods**. BMI and WC records from a total of 4 174 (2 683 male and 1 491 female) participant records from the Special Olympics International Health Promotion database were examined. **Results**. The prevalence of overweight and obesity was quite high (i.e. > 40%), but generally lower than studies involving adults with intellectual disabilities from Europe and the USA. Chi-square analyses revealed that both increasing age and being female significantly predicted levels of overweight, obesity, and WC. **Conclusions**. These results suggest that efforts need to be made to prevent and reduce rates of overweight and obesity among Latin American Special Olympics participants, particularly women.

Keywords: adult; body mass index; overweight; obesity; intellectual disability; waist circumference; Latin America

Foley JT, Lloyd M, Turner L, Temple VA. Índice de masa corporal y circunferencia de cintura en atletas adultos latinoamericanos con discapacidad intelectual. Salud Publica Mex 2017;59:416-422.
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Resumen

Objetivos. Examinar tanto el estado de índice de masa corporal (IMC) como la circunferencia de cintura (WC) en una muestra significantemente grande de participantes internacionales de Olimpiadas Especiales de América Latina. También este estudio exploró la asociación de la edad y el género con la obesidad en esta población. **Material y métodos.** Se examinaron los registros de IMC y WC de un total de 4 174 (2 683 hombres y 1 491 mujeres) del banco de datos de la Promoción Internacional de la Salud de *Special Olympics (Special Olympics International Health Promotion)*. **Resultados.** El predominio de sobrepeso y obesidad fue bastante alta (es decir, > 40%), pero generalmente menor en comparación con los estudios con adultos con discapacidad intelectual de Europa y los Estados Unidos. El análisis Ji cuadrada reveló que tanto el aumento de la edad y ser mujer predijo significativamente los niveles de sobrepeso, obesidad y WC. **Conclusiones.** Estos resultados sugieren que hay que hacer esfuerzos para prevenir y reducir las tasas de sobrepeso y obesidad entre los participantes de las Olimpiadas Especiales de América Latina, particularmente las mujeres.

Palabras clave: adultos; índice de masa corporal; sobrepeso; obesidad; discapacidad intelectual; circunferencia de la cintura; América Latina

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Among adults with intellectual disabilities, higher body mass index (BMI) levels are associated with elevated rates of hypertension,[1,2] hypercholesterolemia,[1] the metabolic syndrome,[3] and Type 2 diabetes.[1,4] High BMIs are also associated with higher serum triglyceride and fasting glucose levels,[5] unsatisfactory oral health status,[6] and more sleep disturbance.[7] Although the abdominal obesity of adults with intellectual disabilities has been studied less often, abdominal obesity assessed via waist circumference (WC) is associated with higher fasting plasma glucose and triglyceride levels,[5] and hypertension.[8] Elevated morbidity among adults with intellectual disabilities is also evident for those who are underweight.[2] In their study of more than 1 000 British adults with intellectual disabilities, Bhaumik and colleagues[2] demonstrated standardized morbidity ratios of 2.4 and 8.4 for underweight women and men, respectively.

Non-communicable diseases associated with obesity such as Type 2 diabetes and stroke, which are major public health concerns across Latin America,[9] and it is clear from international studies that adults with intellectual disabilities experience health risks associated with high BMI and larger WC.[5-8] However, the degree to which adults with intellectual disabilities in Latin America experience overweight/obesity has rarely been examined and rates of abdominal obesity have not been examined. With the exception of one previous study which described the BMI status of Latin American Special Olympics participants for the period 2003 – 2009 as part of a larger international sample,[10] studies of BMI among adults with intellectual disability in Latin America have been generally small in sample size and derived from single country samples, specifically: Argentina,[11] Brazil,[6,12] and Mexico.[13] Evidence from those studies indicates that approximately 40% of individuals have BMI scores in the normal range.[6,10-12]

Rates of underweight of individuals with intellectual disability in Latin America show considerable variation from study to study. In part, this may result from the use of different BMI cut-offs to establish the different weight categories. Using a BMI cut-off of < 20, da Silva and Silva's[12] found that 23.1% of women and 37.8% of men were underweight in a small Brazilian sample ($n = 76$); whereas other studies in Latin America using a of BMI < 18.5 as the cut-off for underweight, reported much lower rates of underweight, specifically: 2.9% in Argentina,[11] 7% in Brazil,[6] and 7.3 and 8.3% among female and male Latin American Special Olympics participants, respectively.[10]

Rates of overweight and obesity among adults with intellectual disability in Latin America also show considerable variability. The rate of obesity (BMI ≥ 30) has been reported as low as 5% in a small sample ($n = 42$) of 13 – 30 year-old males and females in Mexico[13] to 29% in a larger sample ($n = 200$) of both sexes aged 5 – 53 years in Brazil.[6] As neither of these studies stratified their samples by age (i.e. child and adult) it is not possible to more precisely estimate rates of obesity for adults. The rate of overweight (BMI ≥ 25) has been reported as approximately 50% among adults with intellectual disability in Latin America by Batistaa and colleagues[6] and Bronberg and colleagues,[11] but approximately 30% by two other studies.[12,13] Whereas Temple and colleagues[10] found that only female Latin American Special Olympics participants had rates of overweight (BMI ≥ 25) above 50%. The rate of overweight among male Latin American Special Olympics in the Temple and colleagues study was 34%, with the odds of overweight for men being 0.513 (CI: 0.382 to 0.691, $p < 0.001$) compared to women.[10]

This study examined both BMI status and abdominal obesity in a large international sample of adult Special Olympics participants from Latin America. We also investigated sex-related differences. The following specific research questions were addressed: 1) what are the BMI and WC profiles of Special Olympics participants in Latin America and do they differ by sex? 2) Are age and sex associated with the likelihood of being overweight, obese, or having abdominal obesity? 3) Are abdominal obesity and overweight status related among Special Olympics participants in Latin America?

Materials and methods

Data source

Special Olympics International (SOI) is a global not-for-profit sporting organization serving people with intellectual disabilities around the world. SOI has seven world-region offices, including a Latin America office. SOI has been offering free health screenings (e.g. vision, hearing, and anthropometric assessments) at Special Olympics sporting events for more than 15 years. When athletes register to participate in a Special Olympics games, they and/or their guardians sign a medical release/consent form[14] which includes consent for the de-identified data from the Healthy Athletes screenings to be used for research. Ethics approval for this secondary analysis was provided by the institutional ethics review committee of each author's university.

Data collected at the health screenings are entered into SOI databases. For the present study, SOI provided access to the following variables from their Health Promotion database: sex, age, event, location, delegation (country), height, weight, and WC. Anthropometric

measures were assessed directly by trained personnel at Special Olympics events using protocols developed by SOI.[14] Weight was measured to 0.1kg using digital scales and height was measured to the nearest 0.1cm using portable stadiometers. The data for this analysis were collected over the period 2005 to 2011 at different local (78.67%), national (7.35%), regional (2.34%), and world (11.65%) events, and include data from 20 countries, specifically: Argentina, Bolivia, Brazil, Chile, Columbia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guadeloupe, Guatemala, Haiti, Mexico, Panama, Paraguay, Peru, Puerto Rico, Uruguay, and Venezuela.

Data cleaning and analyses

The initial data of 4 897 available entries for participants aged 18-64 years were examined. Data cleaning procedures for BMI, illustrated in figure 1, were as follows: 1) the data were examined and filtered to remove duplicate entries, 2) Listwise deletions were used when anthropometric, sex, or age was missing, and 3) extreme values as identified in previous work.[15,16] The values for inclusion were height between 121.9cm and 238.8cm, and weight between 30.0kg and 317.5kg and WC data with a z score between -4 and 5.

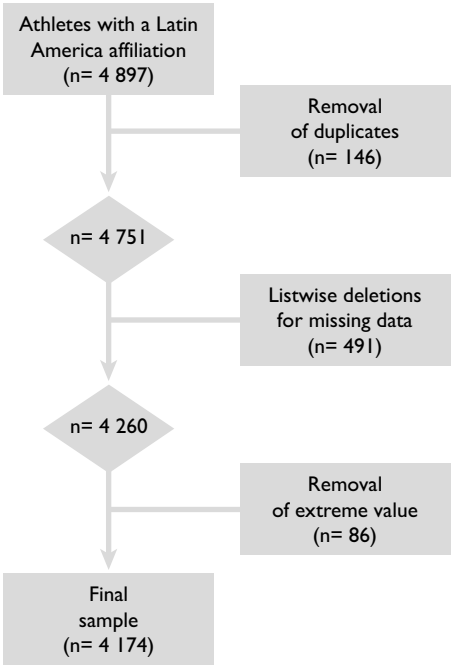

Figure 1. BMI data cleaning procedure

Prevalence rates with confidence intervals were calculated for men and women for four BMI categories based on following World Health Organization[17] cut-points: Underweight <18.5, Normal range 18.5 – 24.9, Overweight 25.0 – 29.9, and Obese ≥30. In addition, the proportion of men and women with WC cut-offs that identified people with abdominal obesity were calculated. The cut-offs used were WC ≥ 94 cm for men and WC ≥ 90 cm for women as suggested by Aschner and colleagues[18] for the general population of Hispanics from the Latin America region. Chi-square analyses were used to examine differences in the proportion of male and female SOI participants who were overweight/obese (BMI ≥ 25) as well as the proportion of participants with a WC higher than the cutoff for abdominal obesity. Binary logistic regression analyses were used to examine whether age (as a continuous variable) or sex (as a dichotomous variable; male = 0, female = 1) were associated with the likelihood of being overweight (BMI ≥ 25), obese (BMI ≥ 30), and having abdominal obesity. For participants with both a WC measure and a BMI score (n = 1 870), a chi-square analysis was used examine whether abdominal obesity and overweight status were statistically independent or whether they were associated. The proportion of participants with WC measures above and below the sex-related cut-offs (men ≥ 94 cm and women ≥ 90 cm) was compared with BMI scores above and below the cut-off for overweight (BMI ≥ 25).

Results

A total of 4 174 (2 683 male and 1 491 female) Special Olympics participants had BMI records after data cleaning, and of that sample, 1 870 (1 233 male and 637 female) WC records were also available. The mean, standard deviation and range of the anthropometric measures and age for both men and women are presented in table I. Table II presents BMI and WC prevalence rates for all participants as well as for men and women separately. Chi-square analyses revealed significant sex-related differences in the overall model for BMI status ($\chi^2 = 49.80$, $df = 3$, $p < .001$). The proportion of participants who were overweight/obese (BMI ≥ 25.0) was significantly higher among women (women = 49.09%, men = 40.81%; $\chi^2 = 26.71$, $df = 1$, $p < .001$). Similarly, the proportion of women with WC levels indicative of abdominal obesity was significantly higher among women than men ($\chi^2 = 5.93$, $df = 1$, $p = .015$). Table III reveals that increasing age and being female were significantly and positively associated with the odds of being overweight/obese, being obese, or having abdominal obesity above the

Table I
Anthropometric measures and age of male and female Special Olympics participants in Latin America

	Male					*Female*				
	N	*Mean*	*SD*	*Min*	*Max*	*N*	*Mean*	*SD*	*Min*	*Max*
Height (cm)	2 683	164.40	9.65	123.00	198.50	1 491	152.82	9.50	125.00	182.00
Weight (kg)	2 683	65.90	13.46	30.00	168.00	1 491	59.21	12.58	30.00	123.00
BMI (kg/m^2)	2 683	24.36	4.48	12.00	70.84	1 491	25.36	4.96	15.03	50.60
Waist circumference (cm)	1 233	83.66	12.15	32.00	138.00	637	80.47	13.42	27.00	144.00
Age (years)	2 683	26.49	8.14	18.00	64.00	1 491	26.50	8.46	18.00	63.00

Note. The data for this analysis were collected over the period 2005 to 2011

Table II
BMI (percent and confidence intervals) and waist circumference of Latin American Special Olympics participants

	All		*Male*		*Female*	
	N	*% (CI)*	*N*	*% (CI)*	*N*	*% (CI)*
BMI (N = 4 174)						
Underweight	260	6.23 (5.50-6.96)	177	6.60 (5.66-7.54)	83	5.57 (4.40-6.73)
Normal range	2 087	50.00 (48.48-51.52)	1 411	52.59 (50.70-54.48)	676	45.34 (42.81-47.87)
Overweight	1 367	32.75 (31.33-34.17)	862	32.13 (30.36-33.90)	505	33.87 (31.47-36.27)
Obese	460	11.02 (10.07-11.97)	233	8.68 (7.62-9.75)	460	15.22 (13.40-17.05)
Waist circumference (N = 1 870)						
Below cut-off for abdominal obesity*	1 472	78.72 (76.86-80.57)	991	80.37 (78.15-82.59)	481	75.51 (72.17-78.85)
Above cut-off for abdominal obesity*	398	21.28 (19.43-23.14)	242	19.63 (17.41-21.85)	156	24.49 (21.15-27.83)

* Cut-off: ≥ 94 cm for men and ≥ 90 cm for women; these data were collected over the period 2005 to 2011

Table III
Odds ratios (and 95% confidence intervals) from logistic regression analyses predicting the effects of age and sex on the likelihood of being overweight, obese and abdominal obesity

Anthropometric measure	*Predictor variables*	*Odds ratio*	*95%CI*	*p*
Overweight/Obese (BMI ≥ 25)	Age	1.036	1.028 to 1.044	< .001
	Sex (0 = male, 1 = female)	1.408	1.238 to 1.601	< .001
Obese (BMI ≥ 30)	Age	1.031	1.020 to 0.041	< .001
	Sex (0 = male, 1 = female)	1.894	1.557 to 2.304	< .001
Abdominal obesity*	Age	1.052	1.039 to 1.065	< .001
	Sex (0 = male, 1 = female)	1.287	1.019 to 1.627	.034

*Waist circumference cut-off of ≥ 94 cm for men and ≥ 90 cm for women

cut-off. The overall model comparing the proportion of participants with WC measures above and below the sex-related cut-offs with BMI scores above and below sex-related cut points for overweight was significant ($\chi^2 = 598.53$, $df = 1$, $p < .001$), with 70.30 % of those below the cut-off for abdominal obesity not being overweight and 94.72% of those classified as having abdominal obesity being overweight.

Discussion

Overall, the rates of overweight and obesity in this study were quite high (i.e. > 40%); however, compared to other BMI published regarding persons with intellectual disability e.g. South Africa,[19] Asia-Pacific,[20,21] Europe,[2,22-24] and United States and Canada;[1,25,26] our data generally show lower levels of overweight/obesity. However, we found similar levels of overweight (BMI ≥ 25) compared to previous studies of Special Olympics participants who were not from the USA[10,27] or Europe.[10] The prevalence of underweight was similar to previous studies of adults with intellectual disability in Latin America, but dissimilar to international studies that demonstrate that men with intellectual disabilities have higher rates of underweight.[10,19,28-30]

Rates of abdominal obesity for participants in this study appear to be generally lower than previous studies of adults with intellectual disability. The mean WC reported in a USA sample of men and women with Down syndrome was 100.4cm and 104.1cm, respectively;[5] whereas in this study mean WC measures were 83.7cm for men and 80.5cm for women. The proportion of adults with WC measures indicative of abdominal obesity in the USA study among persons with Down syndrome[5] was 54% compared to 21% in the present study (19.6% for men and 24.5% for women). This large disparity in the rate of abdominal obesity was also evident among women with intellectual disabilities in general from Taiwan, where the reported rate was 59%.[3] However, only 21% of Taiwanese men with intellectual disability in that same study had abdominal obesity, which is similar to the rate in this study. It should be acknowledged, however, that the cut-off for male abdominal obesity was somewhat higher in this study (≥ 94 cm) compared to that used in the Taiwan study (≥ 90 cm) as ethnic/region-specific WC cut-offs were used for each study.

Of the participants in this study who demonstrated abdominal obesity (WC ≥ 90 in women and ≥ 94 in men), 95% were overweight (BMI ≥ 25). This is of particular concern since evidence suggests that among those who are overweight, high WC is a strong predictor of adverse metabolic profiles.[31] Although there is some preliminary evidence that higher WC is associated with adverse metabolic and cardiovascular outcomes among adults with intellectual disabilities,[5,8] considerably more work needs to be done to document the health risks associated with abdominal obesity in this population, particularly with clinical sub-groups that may not show the same metabolic profile as others with intellectual disability. For example, Braunschweig and colleagues[5] found that the risk factors for Type 2 diabetes and cardiovascular disease were within a desirable range among adults with Down syndrome, despite high rates of overweight, obesity, and abdominal obesity. This suggests there may be unique interactions between obesity and the development of secondary health conditions for persons with particular intellectual disability aetiologies. The concurrent assessment of BMI status, health outcomes, and aetiology is recommended for future research.

Results of the logistic regression analysis support the sex- and age-related differences seen in previous research with adults with intellectual disabilities. Our findings show that women were more likely to be overweight, obese, and have abdominal obesity than men. These sex-based differences are similar to those documented in smaller scale studies conducted in the USA, UK, and South Africa,[1,2,19,22,23] and two larger studies from the USA[28,32] and an earlier international study with Special Olympics participants.[10] The logistic regression analyses also revealed that age was a significant predictor of overweight, obesity, and abdominal obesity. These results are consistent with the modicum of evidence among adults with intellectual disability showing that BMI increases with age.[10,22,33] This result is particularly important given that international evidence indicates that adults with intellectual disabilities are living longer than they have historically[34,35] and have life expectancies that approximate the general population.[36] Prospective research has shown significantly higher mortality rates of among adults in the general population who were overweight or obese during mid-life.[37] Our findings suggest overweight, obesity, and abdominal obesity are health concerns that increase with age, and that women are at particular risk. Research focusing on the medical sequelae, determinants, and management of overweight/obesity as individuals with intellectual disabilities in Latin America age is needed to more fully understand this problem and to design effective interventions.

Major strengths of the current study are the size and the diversity of the countries included in the sample, and that the height, weight, and WC were measured directly rather than relying on self- or proxy-reports. Plus, this is the largest study of BMI among adults with intellectual disability in Latin America and the first study examining abdominal obesity. There are also

several limitations that should be noted. The sample does not proportionally represent the countries listed in the method. For example, 28% of the sample was from Mexico whereas only 0.5% of the sample was from Uruguay. This in part may reflect that approximately 30% of programs in the Latin America region host Healthy Athletes screening events.[38] However, Special Olympics participants from countries that do not host Healthy Athletes screenings are screened when they attend an event in another country. A further limitation is that details of the aetiology of the participants' intellectual disability, comorbidities, and associated health conditions were not available as these variables are not included in the health promotion database.

Overall we found that adult Special Olympics participants from Latin America had high levels of overweight/obesity. For women, the rate of overweight appears to be similar to[39] or somewhat lower than[9] rates of overweight in the general Latin American population of women. In nationally representative samples of Latin American and Caribbean of women, Popkin and Slining[39] reported an aggregated rate of overweight at 50.7% in 2010, which is similar to the 49.1% rate of overweight for women in this sample. For males in this study, rates of overweight seem to be generally lower than those reported by Webber and colleagues[9] (i.e. 42% - 68%). The rate of underweight in this study appears to be higher for both women (5.6%) and men (6.6%) compared to the general population in Latin America.[39,40] Popkin and Slining[39] reported that 3.2% of women in Latin American and the Caribbean were underweight in 2010, down from 7.2% in 1990. Estimates of the rate of underweight for Latin American men were not available in the Popkin and Slining study, however an earlier study reported that 3.6% of adult males in Latin America had BMIs less than 18.5.[40] Reasons for these relatively high rates of underweight among adult Special Olympics participants are unclear and this warrants further investigation.

Recently, Special Olympics International has instigated a Healthy Communities pilot project in fourteen communities around the world. The aim of the pilot is to infuse "health throughout the Special Olympics experience and into the community".[41] One of those pilot communities, *Olimpiadas Especiales México* (Special Olympics Mexico), has been implementing a pilot project to improve the weight status of individuals with intellectual disabilities since January 2013.[42] To date, the project has primarily focused on raising nutrition awareness and the development of three separate education courses: one for Special Olympics athletes; one for parents, teachers, and coaches; and one for professionals. These courses have been taught by *Olimpiadas Especiales México* dieticians at four universities, in management schools for special education principals, at Healthy Athletes events, and via forums for families. Additionally, *Olimpiadas Especiales México* publishes health advice concerning persons with intellectual disability on nutrition, oral health, optometry, and fitness via their website and Facebook page. There are plans to expand and sustain the project in Mexico through alliances with the Ministry of Health, universities, and *Desarrollo Integral de la Familia* (a government organization focusing on family development). Additional information about the pilot project and access to the course educational and teaching materials is available from *Olimpiadas Especiales México*.[42] These health promotion initiatives are currently being evaluated for their effectiveness; however, in the meantime it is promising that in Latin America the Healthy Communities initiative is working to promote a healthy weight status in adults with intellectual disabilities.

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Declaration of conflict of interests. The authors declare that they have no conflict of interests.

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