Overview of obesity research in Mexico

(La vista general de investigación de obesidad en México)

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ABSTRACT

Objective: The objectives were to identify published obesity research from Mexico, topic areas and population groups studied in this field, research gaps, and areas of the country where research capacity building efforts are warranted.

Materials and Methods: Literature searches were performed in several databases to identify obesity-related peer reviewed publications from Mexico published from 2000-2007. The following was gathered from each publication: language; type of research; species studied; sex, age, ethnicity, and geography of participants; and research institution.

Results: 227 publications (~28 per year) were identified. Only 38.3% of these were in Spanish. Most publications studied humans (96.9%), both sexes (76.2%), adults (64.7%), and non-indigenous populations (56.8%) from urban areas (58.6%). The primary author for 56.8% of the publications worked in the Mexico City area.

Conclusion: Information from this review will allow Mexican researchers and funding agencies to better align their research programs to areas of most need.

Key Words: obesity, Mexico, citation databases
INTRODUCTION

Obesity is a leading public health problem and an obvious research priority. While the problem of obesity used to be limited to developed countries, this is no longer the case as the obesity epidemic is now a global phenomenon (1, 2). Mexico is a middle income country in the midst of a nutrition transition, in which the prevalence of overweight and obesity has increased at a tremendous rate over the past two decades. The most recent nationally representative statistics from 2006 indicate that 69.3% of young adults and 30.8% of adolescents in Mexico are overweight or obese; these represent increases from 34.5% and 8.9%, respectively, in 1988 (3). While nutrition research and public health policies in developing countries such as Mexico have historically focused on malnutrition and infectious diseases, there has been a shift to accommodate issues related to obesity and chronic diseases (3, 4).

In light of the issues noted above, we were interested in knowing what obesity research has been conducted in Mexico in recent years. We were also interested in knowing where this research has been conducted, what population groups have been studied, what type of research has been performed, and the rate at which obesity research has increased over time. Thus, the purpose of this review was to assess the current state and trends in obesity research within Mexico. It is anticipated that the findings of this review will: (i) allow researchers to better align their research programs to areas of need, (ii) allow funding agencies to better align their research priorities to understudied areas and population groups, and (iii) identify regions within Mexico that have the greatest capacity to conduct obesity research, and at the same time identify regions of the country where there is a need for capacity building in obesity research.
METHODS

Literature Search

To identify published research on obesity within Mexico, we conducted electronic database literature searches using MEDLINE, PsychINFO, SportDiscus, Web of Science, the Cochrane Library, Academic Search Premier, SocIndex, CAB Abstracts, Fuente Académica, ERIC, PAIS, Scopus, Biblioteca Virtual de Ciencias Sociales de América Latina y el Caribe, SCIELO (Scientific Electronic Library Online), and LILACS (Literatura Latinoamericana y del Caribe en Ciencias Sociales).

Search terms used within the predominately English language databases consisted of [“Mex*”] combined with [“body mass index” “BMI” or “overweight” or “obes*” or “morbid obesity” or “waist to hip ratio” or “waist circumference” or “skinfold thickness” or “adiposity” or “adipose tissue” or “abdominal fat” or “subcutaneous fat” or “nutrition transition”]. Equivalent terms in Spanish were used to search the predominately Spanish language databases: [“Mex*” or “Mex$”] combined with [“IMC” or “indice de masa corporal” or “sobrepeso” or “obesidad” or obes$ or obes* or “obesidad morbida” or “indice cintura cadera” or “ICC” or “circunferencia de cintura” or “medicion del paniculo adiposo” or “medicion del pliegue cutaneo” or “plicometria” or “adiposidad” or “tejido adiposo” or “grasa corporal” or “grasa abdominal” or “grasa subcutanea” or “transicion nutricional” or “modificacion nutrimental” or “transicion de la nutricion”]. The publication dates within each database were limited to papers published between the years 2000 to 2007. This timeframe limit was established to enable thorough systematic searches to be conducted.

After the titles and abstracts of potentially relevant publications were retrieved, they were checked for repetition across the different databases. The title and abstract of each unique
publication were then examined by English and Spanish speaking co-authors to determine if they met the following inclusion criteria: (i) any research related to obesity conducted in a Mexico population (regardless of where the researchers lived) or any animal-based research related to obesity done by a researcher working out of a Mexican institution; and (ii) peer-reviewed publications, defined as articles that have been reviewed by other experts in the field for their quality and pertinence before being published. Obesity could have been the primary focus, secondary influence, or a measure within the study. If the title and abstract did not provide sufficient information to determine if the publication should be included or excluded, a copy of the full publication was obtained. Copies of the full publications were also obtained for those papers that met the inclusion criteria based on the title and abstract. After the full publications were obtained, the reference lists were examined to identify potential publications that were not retrieved in the electronic database searches.

Data Abstraction

The following information was gathered from each publication to provide information on the research performed: (i) language of publication, (ii) type of publication (original study or literature review), (iii) role of obesity in the article (primary or secondary), (iv) species studied (human or animal), (v) sex of participants (males, females, both), (vi) age of participants (children or adolescents, adults, all ages), (vii) ethnicity of participants (indigenous, non-indigenous, mixed), (viii) the type of research performed (biomedical, clinical, health services and policy, and population and public health), (ix) residential geography of participants (urban, rural, mixed), (x) the region of Mexico where the participants were located (north, central, Mexico City, west, south-southeast, entire country), and (xi) the region of Mexico where the institution of the primary author was located.
Obesity was defined as the primary focus of the publication if it had a central role in the study (i.e., the research question would not have been addressed without obesity). The type of research was categorized according to the four pillars encompassing health research, as identified by the Canadian Institutes of Health Research and used in similar reviews of this nature (5). Biomedical research is aimed at understanding normal and abnormal functioning at the molecular, cellular, organ system, and whole body levels. Clinical research focuses towards improving the diagnosis and treatment of disease and injury and improving the health and quality of life of individuals. Included in this category is research on animal models of human disease, clinical trials, and other therapeutic interventions. Health services and policy research has the goal of improving the efficiency and effectiveness of health professionals and the health care system through changes to practice and policy. Population and public health research includes surveillance studies and the way in which our social and physical environment impacts our health. If more than one type of research applied to the publication, the best fit was selected.

The five regions of Mexico, which share common geographic and socioeconomic characteristics, are illustrated in Figure 1 and were made up of the following states: (i) north: Baja California, Southern Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, Sinaloa, and Tamaulipas, (ii) west: Aguascalientes, Colima, Durango, Guanajuato, Jalisco, Michoacan, Nayarit, San Luis Potosí and Zacatecas, (iii) Mexico City (Federal District) and adjacent metropolitan areas of Estado de Mexico, (iv) central: Estado de Mexico, Hidalgo, Morelos, Puebla, Queretaro, Tlaxcala, and (v) south-southeast: Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, and Yucatan. This regionalization is commonly used in surveillance studies of obesity and other health outcomes within Mexico (3, 4).
To illustrate the relation between the number of publications in different regions of Mexico with the population size and regional prevalence of obesity, we created maps of the country which pinpointed the number of obesity publications that came out of different institutions. The states in these maps were color coded according to the population size or the prevalence of obesity. The population size in each state was based on the 2005 census (6). The prevalence of obesity in each state was based on the 2006 National Health and Nutrition Survey (4). States were ranked separately according to the prevalence of obesity in adult men, adult women, adolescent boys, and adolescent girls. The rankings were then averaged to create a summary ranking score, with the 31 states and the Federal District (Mexico City) being ranked from the least obese to the most obese.

**Additional Analyses**

We were also interested in determining the proportion of global obesity research being conducted in Mexico, and trends in such research (from 1990 to 2010) that dated back to the start of the global increase in the prevalence of obesity. The global search was performed using the search term “obes*”. The Mexican search was performed using the search terms “obes*” and “Mex*”. Finally, we were interested in comparing the amount of obesity research within Mexico in the last decade (2000-2009) to other medical conditions and lifestyle behaviors such as hypertension (search terms = hyperten*), diabetes (search term = diabet*), malnutrition (search terms = malnu*), smoking (search terms = cigarette or smoking), and alcohol consumption (search terms = alcohol* or drinking). For practical reasons, these additional analyses were limited to the Medline database, and we did not examine the title and abstracts of these papers to verify their applicability.
RESULTS

Description of Mexican Obesity Research, 2000-2007

The electronic literature searches identified a total of 1677 abstracts. Forty five of these were identified in more than one database and were removed, leaving 1632. A review of the title, abstract, and at times full papers of the 1632 studies indicated that only 207 met the study inclusion criteria. An additional 20 papers were identified by cross-referencing the reference lists of these 207 publications, resulting in a final number of 227 publications. A complete list of the 227 publications is provided in Appendix 1.

A description of the 227 obesity research publications from Mexico between 2000 and 2007 is provided in Table 1. Of these, 61.2% were published in English and 38.3% were published in Spanish. Obesity was the primary focus in 69.6% of the publications. Most of the publications were original research articles (86.8%), studied human populations (96.9%), included both male and female participants (76.2%), were limited to adult participants (64.7%), and studied non-indigenous populations (56.8%) from urban areas (58.6%). The majority of publications (65.6%) were in the population and public health research discipline. No publications were from the health services and policy discipline. More than one third (37.3%) of the publications were limited to participants from Mexico City and approximately one quarter (24.7%) were national in scope.

The primary author for 56.8% of the 227 publications was located at an institution in Mexico City, which was more than all other areas of Mexico combined (30.0%) and institutions from other countries (13.2%). The centralization of obesity research within the Mexico City area is further illustrated in Figures 2 and 3. The dots on these figures indicate the locations of institutions where at least one obesity publication was generated (as first author); larger dots
indicate a higher number of publications. The states in Figure 2 are color coded according to the state population; darker colors indicate more people. The states in Figure 3 are color coded according to the prevalence of obesity; darker colors indicate a higher prevalence. Figure 2 illustrates that more published obesity research was generated from more heavily populated states. Figure 3 illustrates that no published obesity research was generated from institutions from the states with the lowest prevalence of obesity (e.g., Guerrero, Oaxaca, Chiapas), but that some of the states with a relatively high prevalence of obesity (e.g., Campeche, Southern Baja California) also generated no published obesity research from their institutions.

**Secular Trends and International Comparisons, 1990-2009**

The simple Medline search covering the two decade period extending from 1990 to 2009 identified a total of 106,937 global abstracts, of which 500 (0.47%) were Mexican. As illustrated in Figure 4, over the past 20 years there has been a constant increase in the number of global obesity abstracts, with an increase from 1991 abstracts in 1990 to 13,173 in 2009. The secular trend in obesity research in Mexico was similar to that observed globally, with an increase from 13 abstracts in 1990 to 60 abstracts in 2009. However, the sudden increase in obesity research observed globally around 1997 was not observed until around 2003 in Mexico (i.e., there was a sharp increase from 18 abstracts in 2002 to 30 abstracts in 2003). The percentage of global obesity abstracts that were of Mexican origin was relatively stable over time (0.59% from 1990-1994 versus 0.51% from 2005-2009).

**Comparison to Other Research Topics, 2000-2009**

The simple Medline search covering the last decade identified a total of 378 Mexican abstracts in the area of obesity. This was far more than the number of malnutrition abstracts identified in the same time frame (n=75). The number of obesity abstracts also compared
favorably with other behavioral risk factors such as smoking (n=280) and alcohol consumption (n=177) as well as chronic conditions such as hypertension (n=230) and diabetes (n=452).

**DISCUSSION**

The purpose of this paper was to assess the state of obesity research in Mexico, trends over time in such research, and to identify population groups, field areas, and regions of the country that were over or under represented. The results suggest that 227 peer-reviewed publications in the field of obesity were published between 2000 and 2007 (~28 articles per year). Most of this research was conducted in the population and public health research discipline by researchers from the Mexico City area. Over the past 20 years productivity in obesity research in Mexico has increased in a similar fashion to the rest of the world; however, research from Mexico has only accounted for ~0.5% of global obesity research.

An average of 28 peer reviewed publications in obesity from Mexico between 2000 and 2007 indicates that obesity research is underdeveloped in the country as a whole. There are several institutions and even individual researchers from other countries that surpass the number of papers generated in the entire country of Mexico. For example, in a literature search for the year 2007 we identified 285 publications from the Pennington Biomedical Research Center, an obesity focused research center located in Baton Rouge (Louisiana, USA), with an impressive 31 publications from the center’s executive director, Dr. Claude Bouchard.

Approximately 66% of the published obesity research that was conducted in Mexico between 2000 and 2007 was in the population and public health research discipline and another 27% was in the clinical discipline. Only 17 articles were classified as biomedical and not a single article was classified as being in the health services discipline. This is much different than
the situation in Canada where there has been a far greater emphasis on biomedical obesity research than on obesity research within the other disciplines (7). Although limited, the focus on population and public health obesity research in Mexico reflects the research discipline of the regions and institutions within Mexico where most of the obesity research is being conducted. For example, based on the institution of the primary author, the Instituto Nacional de Salud Pública (National Institute of Public Health), the Instituto Nacional de Ciencias Médicas y Nutrición “Salvador Zubirán” (National Institute of Medical Sciences and Nutrition), and the Instituto Mexicano del Seguro Social (National Institute of Social Security) accounted for 5%, 14%, and 18%, respectively, of the total 227 publications (data not shown).

Since Mexico City and its adjacent metropolitan areas accounts for ~18% of the total Mexican population, and many of the national research institutes are located in and around the federal district, it comes as no surprise that the 56.8% of the 227 publications had primary author’s whose institution was located in this part of the country. The publication map in Figures 2 and 3 helps to illustrate areas of Mexico where obesity research appears to be the most developed. Areas with larger populations and higher obesity prevalence rates tended to have more obesity-related publications between 2000 and 2007. While obesity research in the country as a whole was limited, there are many states and regions of the country that did not even generate a single obesity publication.

The simple Medline searches provided us with an indication of worldwide activity in obesity research and Mexico’s contribution to that research. The secular increase in obesity research in Mexico between 1990 and 2009 was similar to that observed globally. However, the sharp increase in obesity research observed globally around 1997 was delayed by about 6 years in Mexico. Throughout the past two decades, about 0.5% of the global obesity research was
from Mexico. Because Mexico accounts for 1.6% of the global population (8), obesity research appears to be underdeveloped in Mexico relative to the rest of the world.

A similar review conducted for Canada suggests that Canada accounts for 3.8% of all global obesity research (7) despite the fact that it only accounts for 0.5% of the global population (8). Clearly, high income countries such as Canada have more resources to support research and research training in obesity and other discipline than middle income countries such as Mexico. For instance, data from the 2005 Mexican census indicated that 42,425 people, or 0.041% of the total population, were undertaking a graduate degree (6). Similar data from the 2006 Canadian census indicated that 130,710 people, or 0.42% of the total population, were undertaking a graduate degree (9). This research disparity between developed and developing countries is well recognized, and the Teasdale-Corti Global Health Research Partnership Program within Canada, the funder of this particular study, is an example of a capacity building initiative that is bringing together researchers from Canada and developing countries (10). Through their Team Grant initiative, the Teasdale-Corti program has funded the CAMBIO (Canadá – México Combatiendo la Obesidad Infantil) project, whose primary objective is to enhance research capacity in the field of childhood obesity in Mexico (http://www.cambio-red.net/). This study will provide a baseline that CABMIO can use to assess the effectiveness if its program.

The simple Medline searches also provided us with an indication of whether the amount of obesity research conducted within Mexico compares favorably to research conducted on other medical conditions and behavioral risk factors. While the amount of obesity research conducted in Mexico is low in comparison to high income countries, it is encouraging to see that within Mexico itself the amount of obesity research was comparable or higher than the amount of research being conducted on malnutrition, hypertension, diabetes, smoking, and alcohol
consumption. A similar analysis at the global level for the years 2000-2003 suggested that there was approximately three times the amount of research being conducted on hypertension and diabetes than obesity (7), despite the fact that obesity is a leading risk factor for both of these medical conditions (11-14).

There are some notable limitations to this study that warrant recognition. This study was limited to peer-reviewed papers in scientific journals. Research that is conducted by government and other agencies is often published as reports and therefore would therefore not have been captured by our review. For practical reasons, the results for the global obesity comparisons and comparisons to other diseases and risk factors within Mexico were limited to searches on the Medline database and the abstracts and publications from these searchers were not reviewed. Thus, these results included many papers that would have not been applicable. We assume that this error was similar in the proportion of both the global and Mexican counts, and the proportion of obesity and other disease counts within Mexico. Therefore, the relative proportions and trends should not be affected.

In conclusion, while the volume of obesity research in Mexico has increased over the past two decades, it is still underdeveloped. Between 2000 and 2007, there was an average of 28 obesity-related peer reviewed publications per year. The majority of this research was in the population and public health or clinical disciplines, with little to no biomedical or health services research. Most of this research was being led by investigators from Mexico City and other central regions of the country, implying that capacity building efforts need to focus more on institutions from other regions. There is an obvious leadership role for some of the more accomplished research institutes and groups from central Mexico in these capacity building efforts.
ACKNOWLEDGEMENTS

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REFERENCES


Table 1. Descriptive information on published obesity research within Mexico, 2000-2007.

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FIGURE LEGENDS

Figure 1: Regions of Mexico that were examined in this review as made up by the following states: (i) north: Baja California, Southern Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, Sinaloa, and Tamaulipas, (ii) west: Aguascalientes, Colima, Durango, Guanajuato, Jalisco, Michoacan, Nayarit, San Luis Potosi and Zaatecas, (iii) Mexico City (Federal District) and adjacent metropolitan areas of Estado de Mexico, (iv) central: Estado de Mexico, Hidalgo, Morelos, Puebla, Queretaro, Tlaxcala, and (v) south-southeast: Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, and Yucatan.

Figure 2: Location of institutions where obesity publications were generated relative to population size. The dots indicate the locations of institutions where at least one obesity publication was generated (as first author); larger dots indicate a higher number of publications. The states are color coded according to the state population; darker colors indicate more people.

Figure 3: Location of institutions where obesity publications were generated relative to the prevalence of obesity. The dots indicate the locations of institutions where at least one obesity publication was generated (as first author); larger dots indicate a higher number of publications. The states are color coded according to the prevalence of obesity; darker colors indicate a higher prevalence.

Figure 4: The number of obesity abstracts identified within Medline for Mexico (circular symbols, axis on left side of figure) and globally (square symbols, axis on right side of figure) from 1990 to 2009.
Figure 3
Figure 4


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