

Are social inequities the reason for the increase in chronic non communicable diseases? A systematics review

Abstract

Non-communicable diseases (NCDs) have increased at an alarming rate in both industrialized countries and the developing world. NCDs, which are highly disabling diseases when allowed to develop freely, can ultimately compromise the lives of those who suffer from them. Over the two last decades, an association has emerged between social inequities and the development of NCDs such as diabetes, obesity, cardiovascular disease, dyslipidemia, asthma and hypertension even while people still face undernourishment and stunting. The purpose of this research is to systematically review the existing indexed literature related to the association between supporting the construction of a system of prevention, education and treatment through national and or international public policies and confronting the increase of these diseases. Four different databases including ALAN, SciELO, Lilacs and Science Direct were reviewed, and a total of 22 articles were found related to the topic. The results of these studies are consistent in supporting the association between social disparities and the emergence of NCDs and reported that living in poverty and low family educational level are the main determinants. Nevertheless, variations according to the specific population context were found, suggesting the complexity of the interaction of social determinants for achieving adequate health.

Keywords: social inequities, poverty, chronic non-communicable diseases, low education, obesity, diabetes, stunting

Volume 1 Issue 3 - 2014

Marianella Herrera-Cuenca,¹ Julio Castro,²
Karina Mangia,³ Maria Alejandra Correa⁴

¹Nutrition and Food Public Policies, CENDES, Central University of Venezuela, Venezuela

²Tropical Medicine Institute, Central University of Venezuela, Caracas, Venezuela

³Department of Nutrition, Sucre Municipality, Venezuela

⁴“Casa de la Mujer” Foundation, Jose Felix Ribas Municipality, Venezuela

Correspondence: Marianella Herrera Cuenca, Nutrition and Food Public Policies, CENDES, Central University of Venezuela, Av Neveri Ed. Fundavac, Piso 1, Caracas, Venezuela, Tel +58 212 753 5859, Email marianella.herrera@ucv.ve

Received: June 30, 2014 | **Published:** August 04, 2014

Abbreviations: NCDs, non-communicable diseases; T2DM, type 2 diabetes

Background

Chronic non-communicable diseases are a major health concern and have been rising in prevalence over the last decades. These diseases commonly include obesity, diabetes, cardiovascular diseases, dyslipidemia, high blood pressure and asthma and lead to costly complications and diminish the quality of life of those who suffer from them. These diseases, particularly obesity, have traditionally been associated with socioeconomic privileges; nevertheless, recent studies have associated non-communicable diseases (NCDs) with disadvantaged conditions such as food insecurity, low income, poverty, inadequate living conditions and unemployment.¹ Eighty percent of the deaths caused by NCDs have been reported to occur in low and middle income countries and have been responsible for 44% of deaths globally. Combined with infectious diseases (including HIV, tuberculosis and malaria), poor maternal and perinatal conditions and nutritional deficits, these diseases double the death rate¹ and will have important economic losses. Over the next 10 years, China, India and the United Kingdom will lose close to \$558 billion, \$237 billion and \$33 billion, respectively, as a result of cardiovascular diseases, stroke and diabetes. These losses will be partly due to the reduced economic activity caused by occupational absenteeism induced by NCDs complications.

Social inequities have been emerging as a risk factor for NCDs together with increased physical inactivity, use of tobacco, alcohol and changes in food consumption patterns.² Social disparities contribute

to the vicious cycle of poverty, which is difficult to break, particularly for those vulnerable groups whose lives are at risk because of issues such as personal insecurity and poor health status. Government interventions are needed in order to promote good quality of life conditions, provide access to adequate nutrition and income through employment, all of which may enhance individuals potential.^{1,3}

Poverty has many faces and can be analyzed from different perspectives. As an example, poverty in Latin America, from a historical perspective, has been a mixture of three types of poverty across the centuries since the American continent was discovered by Christopher Columbus. First, aboriginals lived in poverty; second, those who arrived with the colonizers were impoverished and excluded for many reasons. Third, those individuals who came from Africa were even more impoverished. Thus, poverty in the Latin American continent results from an incomplete process of ethnic, cultural and biological-genetic differences, and these differences should be approached from a more integrated perspective in order to propose adequate solutions.⁴

In the United States, the highest obesity rates have reportedly occurred among population groups with the highest poverty index and lowest education, and an inverse relationship between energy density and energy cost has been shown. In addition, an association exists between poverty and food insecurity on the one hand and lower energy expenditures, low fruit and vegetable consumption and lower quality of diets on the other. The affordability of high energy dense foods versus a diet based on fish, lean meats, fruits and veggies has also been reinforced by the palatability of sugar and fat.⁵ Thus, it is easy to understand why NCDs, particularly those associated with

obesity and co-morbidities of obesity, are increasing in low income populations.

In addition, the so-called Nutrition Transition phenomenon describes body composition alterations due to changes in lifestyle patterns as a consequence of urbanization and migration. This process is occurring at different levels around the world, but is particularly high in low and middle income countries where gaps in the quality of life might be wide among different population groups.^{6,7}

In addition to the previous statements, it should be noted that NCDs can be prevented with cost-effective measures, particularly those associated with lifestyle changes. Obesity and type 2 diabetes (T2DM) are two diseases whose complications can include high blood pressure, dyslipidemia and cardiovascular diseases. Specially for those in poverty, risk factors for diseases start early in life, even in utero and they face a lifecycle of disadvantageous conditions. An undernourished pregnant mother is at risk of having a premature or low birth weight baby, predisposing the baby to cardiovascular diseases later in life.⁸ Frequently occurring in low income settings, pregnancy during adolescence has also shown risks for intergenerational malnutrition consequences such as low height, increased adiposity and early onset of T2DM among others.⁹

A concern for health practitioners that should also be a concern for policy makers is that a large portion of the population still lives in inadequate conditions. A systematic review of the indexed literature was conducted to clarify these aspects within the context of policymaking.

Methods

A systematic search for peer-reviewed information was conducted between March 15 and June 12, 2013 focusing in the association between social inequities and the presence of non-communicable diseases with strong emphasis in Latin America, but not excluding other countries if they were found during the search. We searched in four databases: (3 of which are from Latin America) Latin American Archives of Nutrition database (ALAN), Scielo, Lilacs and Science Direct for published indexed literature between January 2000 and May 2013 using the following terms in Spanish, Portuguese and English: “social inequities”, “social disparities”, “food security/insecurity”, “poverty”, “nutrition transition”, “non-communicable diseases (NCDs)”, “obesity”, “hypertension”, “diabetes” and “asthma”.

The inclusion and exclusion criteria were as follows: original articles published during the established period that showed the association between social inequities expressed as food insecurity, poverty, low income, low socioeconomic status, disadvantaged living conditions and the presence and/or risk of the following non-communicable diseases: obesity, diabetes, hypertension, dyslipidemia, cardiovascular diseases and asthma. Studies included were those in which the unit of analysis was individuals, including children, adolescents and/or adults, or specific groups of households or schools.

Letters to the editor, commentaries or perspectives were excluded, as well as books and grey literature.

The eligibility of the articles was initially ascertained by screening the titles in order to exclude non-relevant studies and remove duplicates of articles identified in multiple databases.

Two investigators (KM and MAC) independently reviewed the studies for eligibility according to the criteria above. Any differences were agreed upon by all authors.

Data extraction and reporting

Because of the relatively novel topic, the team agreed on the above inclusion/exclusion criteria. Traditionally, poverty and its associated social inequities have been related to communicable diseases and poor nutrition, and this phenomenon still exists. The team decided to include any of the manifestations of social inequities, as they express the vulnerable group’s opportunity for exposure to disparities. As a result, analyses of food insecurity, poverty, low socioeconomic status and belonging to a particular ethnic group were included so that different aspects of the life experience in disadvantaged conditions could be approached as determinants of chronic non-communicable diseases. A large emphasis was made on articles on Latin America because of the authors research interests were compatible with this region’s characteristics and the authors are involved in regional projects, whereby understanding social inequities as an influence of developing NCDs would be important. However, articles that fit the inclusion criteria and examined other countries were included because of the topic’s relevance and to learn different approaches.

After searching the four databases, 395 total articles were found; 36, 21, 290 and 48 were found from ALAN, Scielo, Science Direct and Lilacs, respectively. After matching and discarding the duplicates and non-relevant articles for the selected topic, 22 total articles were included in this systematic review as shown in Figure 1.

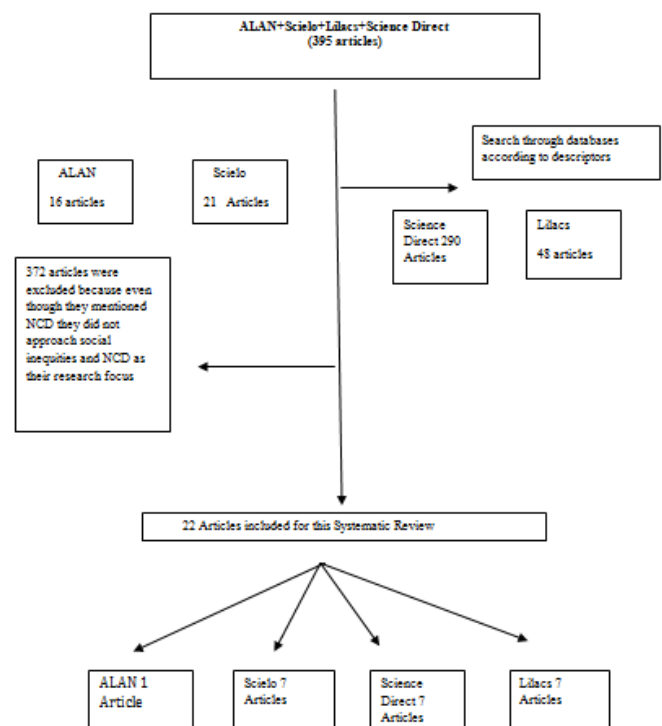


Figure 1 Flowchart of the search and selection process.

Categorization of results

Articles were categorized by their bibliographic characteristics according to the following criteria: number of authors, year of publication, language of publication, country of origin and center or academic institution to which authors are affiliated and the database from which they were obtained (Table 1). The articles were also categorized according to subjects/units of analysis, methodology and findings (Table 2).

Table 1 Categorization of articles according their bibliographic characteristics

Category	Characteristics	Total of authors
Number of authors	1 author	1
	2-5 authors	18
	6 or more	3
Year of Publication	2000-2002	1
	2003-2005	3
	2006-2008	6
	2009-2011	9
	2012-2013	3
Language of Publication	Spanish	11
	English	11
Country of Origin	United States of America	3
	Holland	2
	Switzerland	1
Institution of Affiliation	University	2
	Academic Society, Other	1
	Latin American Countries (Brasil, Mexico, Ecuador, Colombia, Chile and Peru)	16

Results

Of the twenty two retrieved articles, all highlighted the association between social inequities including poverty, food insecurity and other social disadvantaged statuses and different nutritional diagnoses or medical entities. Of these, eight articles were related to obesity and eight were related to cardiovascular disease risk or alterations including hypertension. In addition, one article studied asthma,

one examined metabolic syndrome and four were related to growth impairments including low stature (Table 2).

Studies showing a relationship between a socio-demographic variable and obesity and metabolic syndrome

From these studies, five, showed a trend toward developing obesity with the presence of poverty, food insecurity or living in disadvantaged conditions, while the remaining three showed a trend toward the rise of obesity when socio-economic status is higher. The Peruvian articles showed good examples of differences in results across the same age groups within the same country. For instance, the Health and Familiar surveys (Endes) reported a trend toward the increased risk of becoming obese in extreme poverty strata¹⁵ while Pajuelo et al.¹³ reported a higher prevalence of obesity in higher socioeconomic statuses. Cardenas et al.¹⁸ reported that metabolic syndrome was related to older ages in Peru and decreased while poverty was accentuated. Bustos et al.¹¹ found a relationship between belonging to an ethnic (indigenous) group and a higher risk of becoming obese and stunted but found less risk of becoming obese when living in poverty as a member of a non-indigenous group.

Studies showing associations with cardiovascular diseases

In particular, the association with cardiovascular diseases and at least one of the manifestations of social inequities such as low level of education or lack of schooling appears to be an influencing factor in the presence of cardiovascular disease and mortality as a consequence of these entities. In addition, diabetes appears to be higher amongst groups with low education levels. In contrast, Morenoff et al.,²¹ reported no consistent evidence that social inequities affected the treatment of hypertension in the Chicago area, while Addor et al.,²³ found that a social gradient affected the increase in cardiovascular risk in low educated girls and women in a Swiss study. Carneiro et al.,¹⁹ in Brazil found a significant association between mortality due to CVD and living with low SES.

Table 2 Characteristics of the selected studies grouped by Non Communicable Disease associated to Social inequities

Alteration related to social inequities	Reference	Subjects/Unit of Analysis	Methodology	Descriptors	Results/Findings
Obesity	Yopez R et al. ¹⁰	2.829 Ecuadorans adolescents between 12<19 age from public and private schools	Cross sectional study, probabilistic design, stratified randomized selection, national representatively	Overweight, Obesity, Adolescents, malnutrition, Ecuador	Excess weight is more prevalent in adolescents attending private schools but it is increasing at public schools
	Bustos P et al. ¹¹	1.580.103 Chilean Children indigenous and non indigenous	Retrospective study	Poverty, stunting, obesity, indigenous, Chile	Being an indigenous rises the Risk of becoming obese by 6%, scholars living in poverty had lower Risk of becoming obese RM 1.06; (IC 95% 1.05-1.08) but higher risk of stunting in indigenous RM 2.30 (IC 95% 2.27-2.30)
	Alvarez L. et al. ¹²	2719 households and 5.556 adults between 18 and 69 years	Cross sectional descriptive, retrospective study	Overweight, Obesity, social justice, quality of life, poverty, social class	16,2% of adults were obese 19,1% of women and 11,1 of men were obese, obesity increased at lower SES
	Pajuelo J et al. ¹³	3.669 children less than 5 years old from Peru	Cross sectional study, multiphase, national representative	Pre-school children, infant, Peru, Overweight, Obesity, Nutrition survey	Overweight and Obesity are higher in privileged SES

Table Continued....

Alteration related to social inequities	Reference	Subjects/Unit of Analysis	Methodology	Descriptors	Results/Findings
	Ortiz L et al. ¹⁴	768 school age children	Cross sectional study, convenience sample in 6 schools of Mexico City	Food insecurity, food insufficiency, hunger, overweight, obesity	Children belonging to food insecure households are 2.53 more likely to be overweight compared to those being in secure households independently of sex
	Tazza R & Bullon L ¹⁵	Peruvian Children less than 5 years old	Retrospective Study of the data bases from Health and Familiar surveys (Endes) 1991/1992, 1996 y 2000	Obesity, Nutrition disorders, Pre-school children, Nutritional Status	Overweight and Obesity increased from 17% and 5% to 19% and 7% between 1992-2000 with higher prevalence among children in extreme poverty group. Undernourishment decreased from 12% to 9% in the same period, and children whose mothers were illiterate were at higher risk of chronic undernourishment and stunting
	Guedes DP et al. ¹⁶	5.100 Brazilian Children and adolescents between 6-18 years	Cross sectional survey with multistage sampling	Obesity, Overweight, children, adolescence, Brazil, nutrition assessment, socioeconomic factors	Obesity was significantly higher in girls, who were at 39% elevated Risk of becoming overweight or had 71% increased odds of being obese compared to boys. Children who were engaged in remunerated work were at risk of becoming OW or Obese, those who lived near school were more obese than those who lived far from school and had to walk or bike. Those children belonging to higher SES were at higher risk of being obese
	Schlüssel MM et al. ¹⁷	3.433 children between 0-60 months, 1.529 adolescent women and 10.226 adult women	Retrospective study for evaluating the association between household food insecurity and excess of weight	Food insecurity, nutrition transition, nutritional status	Among adolescent women and adult women experiencing household food insecurity the probability of having excess weight is 1,96 and 1,46 respectively
Metabolic Syndrome	Cardenas H et al. ¹⁸	4.053 adults older than 20 years	Cross sectional, multistage study national representative of Peruvian population	Metabolic Syndrome (MS), poverty, Socioeconomic Status	The Risk of MS on Peruvian population increases gradually with age and decreases while poverty is accentuated
Increased Risk of Cardiovascular diseases and other chronic diseases	Carneiro et al. ¹⁹	Low income communities from the city of Fortaleza, Brazil	Cross sectional, ecologic study through data available from "Sistema Unico de Salud" year 2007	Mortality, social inequalities, deprivation, socioeconomic factors	Significant association between general mortality, mortality due to cardiovascular diseases and external causes and SES (p <0.001) The lower the SES the higher the mortality due to CVD
	Cerezo M et al. ²⁰	10.676 adults between 18 and 69years of age	Cross sectional analytic study	Social inequities, chronic diseases, inequalities in health, body mass index, health surveys, measurements	Higher Risk for diabetes and hypertension (HTA) was found in women and people with no schooling compared to university students. Explanatory variables for HTA and diabetes were gender, age, wealth index and in addition area of residence for diabetes
	Morenoff J et al. ²¹	3105 Adults and over from Chicago Health Study belonging to 343 neighborhoods from the Chicago area	Face to face interviews with blood pressure check ups	Social disparities, neighborhoods, health inequalities, health inequities, blood pressure, hypertension	No consistent evidence of either social disparities in or contextual associations with treatment of HTA, given awareness

Table Continued....

Alteration related to social inequities	Reference	Subjects/Unit of Analysis	Methodology	Descriptors	Results/Findings
	Karlamanga A et al. ²²	5.115 men and women between 18 a-30years old from CARDIA Study	Prospective bi racial cohort study	Socioeconomic factors, Cardiovascular diseases, Risk factors, growth trajectories	Individuals with high overall Risk in midlife for CVD can be identified by their relatively high values of Risk factors in younger ages and that Socio economic differences in cardiovascular Risk start accumulating early in life
	Addor et al. ²³	3.636 adolescents 9 a-19years and 3.299 adults 25 -74 anos	Retrospective study using data from 2 Swiss Health Surveys	Cardiovascular diseases, Risk factors, Child, adolescent, adult, social class, Switzerland, Obesity, Smoking, Exercise, Epidemiology	Discontinuities in the cross sectional ages patterns of Cardiovascular Risk factors, indicated the emergence of a social gradient and the need for preventive actions against the early adoption of persistent unhealthy behaviors to which low educated girls and women are particularly exposed
	Aiello et al. ²⁴	999 adults between 45-84years	Review of cross sectional data from the multi ethnic study of atherosclerosis	Socioeconomic position, immune response, psychosocial stress, cardiovascular disease	Low education was a significant independent factor of higher pathogen burden related to cardiovascular disease
	Redondo A et al. ²⁵	9.646 adults between 35-74years	Retrospective study to analyze the years: 1995, 2000 and 2005	Social determinants, educational level, cardiovascular Risk factors	Prevalence of subjects with diabetes and or hypertension was larger in groups with low educational level
	Barros MB et al. ²⁶	384.764 y 391.868 adults included in PNAD database from Brazil between 2003-2008.	Retrospective study	Chronic diseases, health inequities, health survey, PNAD, Brazil	Increased prevalence of diabetes, hypertension and cirrhosis was observed and prevalence was higher among adults belonging to low educational strata
Asthma	Benicio et al. ²⁷	1.132 children between 6-59month	Retrospective Cross sectional study for reviewing sociodemographic, environmental, nutritional variables and immunization status	Asthma/epidemiology, Risks factors, socioeconomic factors, housing, child, Brazil	The prevalence of recent wheezing episodes was 12.5% and was associated with low per capita income, poor housing conditions, low birth weight (LBW) and poor day care attendance
Growth Alterations in children	Molina E ²⁸	107 children less than 5years, 27 pregnant women, from a low income community in Mexico	Retrospective, longitudinal, comparative study of nutritional status between WHO international standards and CENAN standards	Nutrition assessment, Pregnant women, chronic undernourishment	22,4% of children reported growth retardation of which 1,8% showed severe stunting. 0,9% of children were obese. 29,6% of Pregnant women reported low GWG whereas 18,5% had excessive GWG
	Poel VE et al. ²⁹	Children under 5years old from 47 countries where data from recent demographic health surveys (DHS) are available	Data from most recent demographic DHS available anthropometric data on children less than 5years	Child Health, Urban-rural disparity, developing countries, socioeconomic inequality, Urban poor	There is an urban-rural gap in stunting and mortality being the largest in the Latin American and the Caribbean region. The gap in growth stunting is 1.5 higher than that in mortality. Urban poor children are at risk of stunting
	Poel VE et al. ³⁰	Children up to 5years old in 47 developing countries	Evaluation on anthropometric data from DHS in 47 countries	Childhood malnutrition developing countries, social inequalities	Malnutrition in children is unequally distributed, and eradicating malnutrition does not necessarily reduces social inequalities

Table Continued....

Alteration related to social inequities	Reference	Subjects/Unit of Analysis	Methodology	Descriptors	Results/Findings
	Navarrete CB &Cartes RV ³¹	1.144 Chilean preschool children between 2 - 5years	Descriptive, Retrospective Study using data from "Healthy Child Control"	Preschool children, ethnic, nutrition, obesity, height	Obesity was higher in boys (10,6%) and weight deficit was higher in girls (5,3%). Stunting was higher in boys (25,3%) These outcomes were associated with extreme poverty in the community

Studies showing associations with growth impairments in children

Studies reporting growth alterations essentially focus on stunting. Van de Poel et al.,²⁹ reported a large gap between rural and urban children and highlighted that urban poor children are at risk of stunting. In addition, Molina²⁸ reported that growth alterations occurred in a low income community in Peru in which obesity is as low as 0.9% of the studied population, while 22.4% reported growth retardation and 1.8% was severely stunted. Navarrete et al.,³¹ reported that obesity was higher in Chilean boys between 2-5years of age (10.6%) compared with girls (5.3%); 25.3% of the boys showed stunting and these outcomes were associated with extreme poverty.

Study showing associations with asthma

An association was reported between asthma and poor housing conditions, low per capita income and low birth weight in a study by Benicio et al.²⁷

Discussion

The rise in the prevalence of non-communicable diseases worldwide is a serious issue, particularly in the developing world where good life conditions might not reach a large proportion of individuals. How social inequities are associated with the appearance of NCDs is a complex question to answer. Globalization and demographic transition and urbanization processes had been keys to generating economic development. On the one hand, these processes have made interesting improvements in health achievements but have contributed to rise of social disparities on the other hand.³²

Uncontrolled access to unhealthy foods and the fact that some groups who previously did not have consistent access to food now can regularly access cheap and calorie-dense food have been determinants in the rising prevalence of overweight and obesity in disadvantaged groups.⁵

As evidenced in the majority of the articles above, an association between social inequities and the presence of non-communicable diseases, particularly between obesity, increased cardiovascular risks, diabetes and altered growth pattern in children has emerged as an interesting topic for research. The traditionally expected outcome for those living in poverty is changing from undernourishment and classic stunting to the coexistence of obesity and excess weight and stunting and low weight, as shown in several studies, highlighting the presence of "the double burden of malnutrition".⁶

Interestingly, when analyzing the studies, differences within the same country could be observed. In one community, characteristics of low income, poverty and social inequities and the consequences of over nutrition status and NCDs can result in an increase in the prevalence of obesity, while the same sociodemographic characteristics in other

communities can manifest as marked undernourishment.^{13,15,28} This should be taken cautiously when analyzing social determinants of NCD since characteristics of the communities themselves can influence particularly the nutritional outcomes, rather than an absolute criteria of the association of poverty and being socially disadvantaged and the presence of overweight and obesity this show the multidimensionality of social factors and their complex interactions.

In addition, a gap between the rural and urban population was observed, resulting in different perspectives for analysis and interpretation. This gap is evident in children's nutritional status, as observed in Mexico City where children attending 6 schools were 2.53 more likely to be obese if living in food insecure households than their food secure counterparts.¹⁴ By contrast, in a more rural, small city (Chalhuanca, Peru), a sample of children had an obesity prevalence of 0.9% and 22.4% had stunted growth.²⁸

Wasting in children, manifesting as low weight for height, is caused mainly by immediate caloric deficiencies and has been associated traditionally with food insecurity and hunger. On the other hand, stunting or chronic malnutrition happens when consistent low levels of insufficient caloric intake are present and are also associated with micronutrient deficiencies.³³ Wasted children are susceptible to disease while stunting reduces later performance at school and income as adults. Moreover, stunting starting early in life increases the risk of obesity and NCDs later in life, which is a key motivation of this present article.³⁴

As a result, these differences might mean that access to opportunities is unevenly distributed among the population and that the nutrition and demographic processes are at different levels of evolution in different regions. Additionally, as was shown in an important quantity of the articles in this review, low education level is a key factor, particularly nutritional knowledge. While not specifically addressed in these articles, lack of nutritional knowledge is as an obstacle to achieving good health and preventing the presence and evolution of NCDs when improved outcomes such as obesity are ameliorated.³⁵

Equally important is the types of disadvantages these communities are experiencing. Thus, programs and interventions cannot be the same for a totally deprived community compared with a low income community.

There are several definitions and categorizations of poverty, including differences in approaches according to the elements taken into account. The one introduced by Walter³⁶ is an interesting one, as it describes a classification in external poverty characterized by low income and difficulties for maintenance and internal poverty that would include potentially harmful effects on good and adequate nutrition. The latter concept would refer to knowledge and beliefs about nutrition and attitudes as a key factor of good eating habits that are even more important than income. A recent study found

no relationship between income and obesity in a disadvantaged population. However, when considering the line of poverty, the association was statistically significant, also low level of education was a factor that increased the risk of being obese, which is important when considering the multidimensionality of poverty for analysis.³⁷

The aspects that are to be considered when assuming the different aspects of poverty are more complex than just lack of adequate income. In spite of being important elements for quality of life, low education, lack of nutritional knowledge and family structure are aspects that will impact nutritional adequacy and ultimately the development of a chronic condition related to nutritional disease.^{4,38}

The formula to explain the increasing prevalence of non-communicable diseases is complex and it reflects cultural, geographical, genetic and other differences. NCD as shown can express in affluent communities as well as in disadvantaged ones. However, inequality in access to goods and services is a constant; in a changing world, understanding that malnutrition and obesity can be expressions of inequalities in access to food and education requires a methodological effort. It is not logical to think that less food results in more malnutrition and that more food results less malnutrition. The nutrition transition phenomenon does not appear to be a continuum from the weight-height deficit towards obesity through normal status. Rather, it seems that the two poles of malnutrition and obesity are on one side of the spectrum and normal on the other and determining the factors for non-communicable diseases.

Acknowledgements

None.

Conflict of interest

Author declares that there is no conflict of interest.

References

1. Daar AS1, Singer PA, Persad DL, et al. Grand Challenges in Chronic non-communicable diseases. *Nature*. 2007;450(7169):494–496.
2. Narayan KM, Ali MK, Koplan JP. Global noncommunicable diseases--where the worlds meet. *N Engl J Med*. 2010;363(13):1196–1198.
3. Espana LP, Villasmil R, Santos MA, et al. Políticas para la construcción de oportunidades sociales y reducir la desigualdad. In: Equipo Acuerdo Social, editor. *Venezuela: Un acuerdo para el desarrollo*. Caracas, Venezuela: Publicaciones UCAB; 2006. 25–40p.
4. Bengoa JM. About, within, against poverty. Conference at Simon Bolívar University. Sartenejas Valley, Venezuela; 1990.
5. Drenowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr*. 2004;79(1):6–16.
6. Blanco ML, Carmona A. La transición alimentaria y nutricional: Un reto en el Siglo XXI. *An Venez Nutr*. 2005;18(1):90–104.
7. Popkin BM. The Nutrition Transition in low-income countries: an emerging crisis. *Nutr Rev*. 1994;52(9):285–298.
8. Gluckman PD, Hanson MA, Cooper C, et al. Effect of In Utero and Early Life Conditions on Adult Health and Disease. *N Engl J Med*. 2008;359(1):61–73.
9. Haeri S, Guichard I, Baker A, et al. The Effect of Teenage Maternal Obesity on Perinatal Outcomes. *Obstet Gynecol*. 2009;113(2 pt 1):300–304
10. Yopez R, Carrasco F, Baldeon M. Prevalencia de sobrepeso y obesidad en estudiantes adolescentes ecuatorianos del area urbana. *Arch latinoam nutr*. 2008;58(2):139–143.
11. Bustos P, Munoz S, Vargas C, et al. Pobreza y procedencia indigena como factores de riesgo de problemas nutricionales de los niños que ingresan a la escuela. *Salud Publica Mex*. 2009;51(3):187–193.
12. Alvarez L, Goez J, Carreno C. Social and economic factors associated with obesity: the effects from inequality and poverty. *Rev Gerenc Polit Salud*. 2012;11(23):98–110.
13. Pajuelo J, Miranda M, Campos M, et al. Prevalencia de sobrepeso y obesidad en niños menores de cinco años en el Perú 2007-2010. *Rev Peru Med Exp Salud Publica*. 2011;28(2):222–227.
14. Ortiz L, Acosta M, Nunez A, et al. En escolares de la Ciudad de Mexico la inseguridad alimentaria se asocio positivamente con el sobrepeso. *Rev Invest Clin*. 2007;59(1):32–41.
15. Tazza R, Bullon L. Obesidad o desnutricion? Pobreza actual de los niños peruanos menores de 5 años. *An Fac Med Lima*. 2006;67(3).
16. Guedes DP, Rocha GD, Silva AJ, et al. Effects of social and environmental determinants on overweight and obesity among Brazilian schoolchildren from a developing region. *Rev Panam Salud Publica*. 2011;30(4):295–302.
17. Schlussek MM, Silva AA, Perez ER, et al. Household food insecurity and excess weight/obesity among Brazilian women and children: a life-course approach. *Cad Saude Publica*. 2013;29(2):219–226.
18. Cardenas QH, Sanchez AJ, Roldan AL, et al. Prevalencia del síndrome metabólico en personas a partir de 20 años de edad, Perú, 2005. *Rev Esp Salud Publica*. 2009;83(2):257–265.
19. Carneiro D, Salgado A, Taracido Ma, et al. Efecto de las Desigualdades Socioeconomicas en la Mortalidad de la Ciudad de Fortaleza, Ceara Brasil Durante el año 2007. *Rev Esp Salud Publica*. 2010;84(4):443–452.
20. Cerezo M, Cifuentes O, Nieto E, et al. Desigualdades por la morbilidad por enfermedades crónicas según determinantes estructurales e intermediarios. *Rev Gerenc Polit Salud*. 2011;(23):165–188.
21. Morenoff J, House J, Hansen B, et al. Understanding Social Disparities in Hypertension Prevalence, Awareness, Treatment, and Control: The Role of Neighborhood Context. *Soc Sci Med*. 2007;65(9):1853–1866.
22. Karlamangla A, Singer B, Williams D, et al. Impact of socioeconomic status on longitudinal accumulation of cardiovascular risk in young adults: the CARDIA Study (USA). *Soc Sci Med*. 2005;60(5):999–1015.
23. Addor V, Wietlisbach V, Narring F, et al. Cardiovascular risk factor profiles and their social gradient from adolescence to age 74 in a Swiss region. *Prev Med*. 2003;36(2):217–228.
24. Aiello A, Diez-Roux A, Noone A, et al. Socioeconomic and Psychosocial Gradients in Cardiovascular Pathogen Burden and Immune Response: The Multi-Ethnic Study of Atherosclerosis. *Brain Behav Immun*. 2009;23(5):663–671.
25. Redondo A, Benach J, Subirana I, et al. Trends in the Prevalence, Awareness, Treatment, and Control of Cardiovascular Risk Factors across Educational Level in the 1995–2005 Period. *Ann Epidemiol*. 2011;21(8):555–563.
26. Barros MB, Francisco PM, Zanchetta LM, et al. Trends in social and demographic inequalities in the prevalence of chronic diseases in Brazil. PNAD: 2003- 2008. *Cien Saude Colet*. 2011;16(9):3755–3768.
27. Benicio M, Ferreira M, Cardoso M, et al. Wheezing conditions in early childhood: prevalence and risk factors in the city of Sao Paulo, Brazil. *Bull World Health Organ*. 2004;82(7):516–522.
28. Molina E. Evaluación del estado nutricional antropométrico de niñas, niños menores de 5 años y gestantes. *Renut*. 2010;4(14):705–714.
29. Poel VE, Donnell OO, Doorslae VE. Are urban children really healthier? Evidence from 47 developing countries. *Social Science & Medicine*. 2007;65(10):1986–2003.

30. Poel VE, Reza AH, Speybroeck N, et al. Socioeconomic inequity in malnutrition in developing countries. *Bulletin of the World Health Organization*. 2008;86:282–291.
31. Navarrete CB, Cartes RV. Estado nutricional de preescolares de la comuna Alto Biobio y su relación con características etnodemográficas. *Rev Chil Nutr*. 2011;38(1):52–58.
32. Prahalad C.K. Private Sector and Poverty: Progress During 2005-2009 in Prahalad CK The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits. Revised and Updated. 5th Ed. New Jersey, USA: Pearson Education, Inc Publishing as Wharton School Publishing; 2010.
33. Neufeld L, Osendarp SJM. Global, Regional and Country Trends in Underweight and Stunting as Indicators of Nutrition and Health of Populations. In Black RE, Singhal A, Uauy R, editors. International Nutrition: Achieving Millenium Goals and Beyond. *Nestle Inst Workshop Ser*. 2014;78:11–19.
34. Victora CG, Adair L, Fall C. Maternal and Child undernutrition: Consequences for adult health and human capital. *Lancet*. 2008;371(9609):340–357.
35. Klohe-Lehman DM, Freeland-Graves J, Anderson ER, et al. Nutrition Knowledge Is associated with Greater Weight Loss in Obese and Overweight Low Income Mothers. *J Am Diet Assoc*. 2006;106(1):65–75.
36. Walter JP. Internal External Poverty and nutritional determinants of Urban Slum Youth. *Ecol Food Nutr*. 1973;2(1):3–10.
37. Herrera Cuenca M. Evaluación de los Expendios de Alimentos utilizados por diferentes programas de alimentación, Revisión Sistemática. *An Venez Nutr*. 2011;24(2):86–91
38. Blanco LM, Landaeta-Jimenez M, Macias Tomei C. Contribución del Crecimiento prenatal y posnatal temprano en las enfermedades crónicas relacionadas con la nutrición. *An Venez Nutr*. 2013;26(1):26–39.