



Original / *Síndrome metabólico*

# Efficacy of social support on metabolic syndrome among low income rural women in Chiapas, México

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## Abstract

**Introduction:** The purpose of this study was to assess a social support intervention among rural women from Chiapas and its ability to change lifestyles, self-concept, and Metabolic Syndrome (MS).

**Methods:** A convenience sample was conducted among older than 16 yo women from a marginalized rural community from central Chiapas. Two questionnaires were used, a self-concept questionnaire and a healthy lifestyle profile. Criteria for components of MS used were those of the International Diabetes Federation. The intervention was conducted over a three month period and divided into 13 sessions that concentrated on social support and were complemented by nutrition education modules.

**Results:** Five hundred eighty six participants met inclusion criteria for the study. At basal time 47% had MS; abdominal obesity, 69%; high levels of glucose, 27%; triglycerides, 56%; systolic blood pressure, 17%; diastolic blood pressure, 15%; and low levels of HDL-cholesterol, 55%. After the intervention, 38% had MS and significant differences were observed in all of the components of MS. The pre and post-intervention dimension scores on the self-concept form 5 (AF5), or self-concept questionnaire, and the Pender Health Promotion and Lifestyle Questionnaire (PETS-1) also yielded significant differences.

**Conclusions:** After a three month social support and nutrition education intervention, significant changes were observed in several dimensions of the AF5 and PETS-1, as well as in MS and its components.

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Key words: *Social support. Mexican women. Rural communities. Metabolic syndrome.*

## EFICACIA DEL SOPORTE SOCIAL SOBRE EL SÍNDROME METABÓLICO EN MUJERES DE ÁREA RURAL DE CHIAPAS, MÉXICO

### Resumen

**Introducción:** El propósito de este estudio fue valorar una intervención de soporte social entre mujeres rurales de Chiapas, sobre los cambios en el estilo de vida, el auto-concepto, y el síndrome metabólico (MS).

**Métodos:** Se realizó una muestra de conveniencia entre todas la mayores de 16 años de una población rural marginada del centro de Chiapas. Se utilizaron dos cuestionarios. Uno sobre el auto-concepto de salud y el otro sobre el perfil de estilos saludables. Los componentes del MS se valoraron de acuerdo a los criterios de la Federación Internacional de Diabetes. La intervención se realizó durante un período de tres meses y se dividió en 13 sesiones que incluían soporte social (SS) y educación nutricional (EN).

**Resultados:** Cumplieron con los criterios de inclusión, 586 mujeres. Al inicio del estudio 47% tenían MS; obesidad abdominal, 69%; altos niveles de glucosa, 27%; de triglicéridos, 56%; de presión arterial sistólica, 17%; de presión arterial diastólica, 15%; y bajos niveles de colesterol-HDL, 55%. Después de la intervención 38% presentaron MS y se observó una reducción de todos los componentes del MS. Al final del estudio se observaron cambios significativos en AF5, PETS-1 y algunos componentes del SM.

**Conclusiones:** Después de una intervención de SS y EN, se observaron cambios significativos en varias dimensiones del AF5 y del PETS-1, así como en SM y todos los componentes del SM.

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Palabras clave: *Soporte social. Mexicanas. Comunidades rurales. Síndrome Metabólico.*

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## Introduction

Obesity (O) has become a worldwide pandemic.<sup>1</sup> In developing countries and among migrants and poor people in developed countries the prevalence of O is increasing dramatically.<sup>2,6</sup> This increment is associated with diabetes and other chronic diseases in Mexico and other developing countries.<sup>7</sup> In Tijuana, one of Mexico's largest cities, has recently been identified as a place where the prevalence of O and abdominal obesity in its poor, urban populations is significantly higher than in its high socioeconomic status populations.<sup>8</sup> Among 17 rural communities in Oaxaca, the Mexican state with the second lowest human development index, an increase in the prevalence of O in rural population has also been observed from 1970 to 2007.<sup>9</sup> Sanchez et al conducted a six week nutritional intervention among 119 mothers of pre-school children in Oaxaca, and they observed an increase in the knowledge of the healthy foods included in lunch packs.<sup>10</sup> Urban sections of Chiapas, the Mexican state with the lowest human development index, reported a high prevalence of overweight and O among infants of low income mothers.<sup>11</sup>

Most countries have developed national action plans to fight overweight (OW) and O;<sup>12</sup> however, few of them include plans that have been based on the evaluation of their efficacy and effectiveness. In fact, guidelines for Latin-American countries have been drafted as though they were a homogeneous population area. The reality is that with more than 80 ethnic groups, huge disparities in socioeconomic status, education, and access to an appropriate health care system among the regions and among the urban and rural communities within the countries, they are anything but homogeneous.

On the other hand, very few high quality, individual and community studies have shown substantial improvements in weight gain prevention and treatment of O.<sup>13</sup> Evidence shows that prevention and treatment in well-designed studies have been elusive.<sup>14</sup> Therefore, evidence based and cost-effective and affordable preventive measures are warranted at rural and poor communities.

Some authors have suggested that social support (SS) organizations/programs should include effective strategies that will foster long term weight loss, since this approach could prevent relapses and increase adherence to the program.<sup>15,16</sup> These programs incorporate different components of inter-relation dynamics, such as self-help support, group support, encouragement toward competitiveness, and promotion of the learning process towards the implications of a disease.<sup>14</sup> In a recent systematic review of randomized clinical trials among older than 18 yo women it was observed that not a single study was conducted in a Latin-American country, and none among rural populations; however, the difference in weight loss between those with the social support intervention and the control group

ranged from -2.7 kg after 24 months to -8.3kg after 12 months.<sup>16</sup>

The purpose of this study was to assess an educational intervention through social support and interrelation dynamics among rural women from Chiapas in a pre and post test design to change lifestyles, self-concept, components of MS, and MS.

## Methods

### *Setting*

Chiapas is a southeast Mexican state and it borders Guatemala. According to the 2010 census,<sup>17</sup> Chiapas had approximately 4,796,580 residents: 51% living in rural areas. Net migration rate projections for Chiapas were -0.3, and the human development index was 0.58, ranking last among all the states of Mexico.<sup>17</sup> Additionally, the population older than 18 y old has an average of 6.7 years of education, and 18% are illiterate. Twenty per cent of households are run by single women. Among adults the main cause of death is diabetes mellitus, which is higher in women; the second cause of death is heart disease, which is higher in men.<sup>17</sup>

Approximately 90% of the population had less than 600 dls of monthly income; therefore, approximately 65% of the total population is eligible to receive health care services at the Health Secretary System, which is the health care subsystem that provides the most basic health services in Mexico.<sup>17</sup>

### *Type of study, population, and sample*

This is a community intervention study in a convenience sample of women living in a rural area of central Chiapas. The women were eligible to be supported by the program "Oportunidades" a government program serving underprivileged populations. All women 16 to 80 yo, living in the community, were invited to participate during an open information meeting.

### *Questionnaires*

Two questionnaires were used: a self-concept questionnaire, AF5,<sup>18</sup> and the Pender Health Promotion and Lifestyle Questionnaire, PEPS-1.<sup>19</sup> The AF5 assesses physical, social, emotional, labor, and family dimensions; the PEPS-1 evaluates six subscales: nutrition, exercise, health responsibility, stress management, internal support and self-actualization. The questionnaires were answered through an interview using a Likert scale where 1 was never and 4 was mostly

In the pilot study a sample of 2% of the total women, 17 to 76 y old, was chosen. The questionnaires were applied for reproducibility and internal validity. Total

Chronbach alpha for the AF5 was 0.85 for all dimensions. Results for the individual dimensions were as follows: 0.56 for physical activity; 0.73 for labor, 0.7 for social, 0.64 for family, and 0.62 for emotional. Total Chronbach alpha for PEPS-1 was 0.92. Results for the individual subscales were as follows: 0.87 for self-actualization; 0.84 for social support; 0.81 for physical activity and stress management; and 0.74 for nutrition and health responsibility.

### *Recruitment and training*

The survey was conducted by nineteen nutrition students in their fourth and fifth year. They were trained to lead the interview and take the anthropometric measurements at the households of the participants. The students were trained at a central location on how to take anthropometric measurements using a portable scale, a stadiometer, and a measuring tape to determine weight, height, and waist circumference. All students measured four adults (two sets of two randomly assigned to a pair of observers) to assess inter-observer measurement reliability. Inter-observer reliability of height (m), weight (kg) and waist circumference (cm) measurements were 0.92, 0.96 and 0.86, respectively.

The researchers used leaflets and the support/encouragement of community leaders to invite all the women in the community to participate. A meeting with the respondent participants took place at a school located in the community. The program's purposes were explained, and the attending women, older than 18yo, were invited to participate in the study. Those who agreed signed an informed consent form.

### *Measurements*

Blood pressure, pulse and body temperature were measured according to standard procedures recommended by the Minister of Health (NOM-030-SSA2-1999).<sup>20</sup>

Anthropometric measurements of height, weight and waist circumference were conducted according to the standards recommended by the Minister of Health (Lohman, Roche, y Martorell, 1988; NOM-174-SSA1-1998).<sup>21,22</sup> Height was measured to the nearest millimeter using an ultrasonic stadiometer (ADE, Germany). Weight was measured to the nearest 0.1 kg using an electronic scale (ADE, Germany). Subjects were dressed in light clothing and barefoot. BMI was calculated with the following formula: weight (kg)/height<sup>2</sup> (m). Waist circumference (WC) was measured at the minimum circumference between the iliac crest and the rib cage.

A blood sample was taken by an experienced biochemist technician according to the techniques recommended by the Minister of Health (NOM-037-SSA2-2002; NOM-015-SSA2-2010).<sup>23,24</sup>

Venous blood samples were collected at baseline and 3 months after the beginning of the study. The samples were taken at 8 a.m. from an antecubital vein after a 12-h overnight fast. Before processing, the blood samples were centrifuged at 3500 × g for 3 min in a SOLBAT centrifuge at 4°C, and plasma was removed and analyzed immediately after collection. For quantitative determination of glucose and cholesterol, total cholesterol and triglycerides in serum, a colorimetric enzymatic method was used (GLUCOSE PAP SL, ELITECH, France). To determine HDL-cholesterol the precipitation method was used combined with a colorimetric enzymatic method (CHOD-PAP, RANDOX LAB LTD, UK); triglycerides measurement was conducted by enzymatic hydrolysis with lipases (GPOP-PAP, RANDOX, UK). LDL-cholesterol was calculated using the Friedewald formula: LDL (mmol/L) = total cholesterol – (TG/5) – HDL, accurate to samples with values under 400mg/dl. All the measurements were conducted by a spectrophotometer RA-50 (Clinical Chemistry System, Bayer, Germany).

To assess the presence of Metabolic Syndrome the International Diabetes Federation (IDF) criteria<sup>25</sup> was used, where waist circumference is ≥ 80cm or BMI ≥ 30 kg/m<sup>2</sup>, plus any two of the following four factors: triglycerides ≥ 150 mg/dL (1.7 mmol/L) or specific treatment for this lipid abnormality; HDL-cholesterol < 50 mg/dL (1.29 mmol/L) in females or specific treatment for this lipid abnormality; systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg or treatment of previously diagnosed hypertension; fasting blood glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes.

### *Type of intervention*

A SS program, including self-help, group support and nutrition education to change self-concept/perception and lifestyles was conducted over a three month period and divided into 13 sessions. Participants were divided into six groups of 32 women each. The components of each session included: introduction to the program, general approaches to selected topics (nutrition, health, and psychology), social support and inter-relation group dynamics, structured physical activity and closing remarks.

### **Sessions**

#### *Introduction*

During this phase the purpose of the study was reintroduced to the whole group and after signing the informed consent the participants' demographics, clinical data, and anthropometric measurements were taken.

### *General approaches to selected topics (nutrition, health, and psychology)*

Selected topics were explored in an interactive, dynamic manner. Some of the topics covered were the cardiovascular system, self-concept of body image, overweight and obesity, self-esteem, healthy diet, self-knowledge of one's strengths and weaknesses, acceptance of one's personality and lifestyles, the role and values of women in society, the importance of the role of women in society and the family, mental health, stress management, and self-empowerment.

### *Social support and inter-relation group dynamics*

In each session dynamic groups and inter-relation group dynamics were applied to reinforce each of the topics discussed and promote group cohesion, including questions and answers modules about individual barriers to lifestyle changes and group support. Music and leaflets were also used to support the sessions.

### *Structured physical activity*

During the first six sessions, women were enrolled in low intensity aerobic exercise, each session was 30 minutes long; for the remaining seven sessions the women performed median impact aerobics, combined with anaerobic exercise, and these were also 30 minutes long.

### *Closing remarks*

At the end of each session women received/reviewed their clinical record and researchers explained the observed changes in their clinical charts.

### *Evaluation procedures*

Two weeks into the intervention an evaluation of the program was performed via a questionnaire assessing the participant's attitudes towards the intervention; and simultaneously the AF5 and PEPS-1 questionnaires were applied. Anthropometric measurements and a blood sample for biochemical variables were also taken.

### *Statistical analysis*

Anthropometric, biochemical, blood pressure, and AF-5 and PEPS-1 total scores for each dimension were examined to assess normality. Paired two-tailed Student's t-tests were used to evaluate mean differences in pre and post intervention for all variables

studied. Changes in proportions of components of MS and criteria of MS were assessed with Pearson Chi-square test.

### *Ethics approval*

The study was approved by the ethics committee of the Nutrition School of the Universidad de Ciencias y Artes de Chiapas, and the participants signed an informed consent form.

## **Results**

Seven hundred and sixty two women attended the first meeting and agreed to participate in the study. However, only five hundred eighty six participants met the inclusion criteria for the study and had accurate data of anthropometric measurements, biochemistry, and the AF5 and PEPS-1 at the beginning of the study. Adherence at the end of the study was higher than 80%.

Mean age was  $38.5 \pm 13.1$  (17-65) years, BMI  $26.5 \pm 4.5$  kg/m<sup>2</sup>, and waist circumference  $84.6 \pm 9.8$  cm. Ninety one percent of the population had not received more than six years of formal education; however, 76% reported being able to read in Spanish. On the other hand, 99% had never used a computer, 82% watched TV daily, and 18% percent reported walking more than 30 minutes daily.

At the beginning of the study the following was found: the prevalence of MS among participant was 47%; BMI > 30 kg/m<sup>2</sup>, 42%; waist circumference > 80 cm, 69%; Glucose > 100 mg/dL, 27%; Tryglicerides > 150 mg/dL, 56%; Systolic Blood Pressure mm/Hg, 17%; Diastolic Blood Pressure mm/Hg, 15%; and HDL-Cholesterol  $\leq 50$  mg/d, 55%.

The pre and post intervention percentage and remission of metabolic syndrome criteria are shown in table I. Table II shows the pre and post analysis of the AF5 and PEPS-1 scores.

## **Discussion**

The first alarming observation of this study is the high prevalence of MS and its components. Additionally, among this group of women from rural Chiapas, with the specific characteristics of being very poor and with limited formal education, after a three month community intervention based on SS techniques and promoting changes in self-concept and lifestyles, significant changes were observed in several dimensions of the AF5 and PETS-1, as well as in MS and its components.

The high prevalence of MS among this population is consistent with the high prevalence of obesity among infant and toddler children from low income families in Mexico,<sup>11</sup> and in low, middle and high SES middle

**Table I**  
*Frequency and remission of metabolic syndrome components*

	Pre intervention (n)	Post-intervention (n)	Remission (%)	P*
BMI > 30kg/m <sup>2</sup>	242	102	58	0.0001
Waist Circumference ≥ 80 cm	405	388	4	0.0001
Glucose ≥ 100 mg/dL	159	154	3	0.001
Triglycerides ≥ 150 mg/dL	330	277	16	0.001
Systolic Blood Pressure ≥ 130 mm/Hg	98	80	18	0.0001
Diastolic Blood Pressure ≥ 85 mm/Hg	86	61	29	0.0001
HDL-Cholesterol < 50mg/dL	319	286	10	0.0001
Metabolic Syndrome	274	223	19	0.0001

\*Chi-square test.

**Table II**  
*Pre and post changes of the AF5 and PEPS-1 mean dimensions scores*

Dimensions	Pre intervention Mean ± SD	Post intervention Mean ± SD	P*
<i>AF5</i>			
Social	6.5 ± 1.6	6.6 ± 1.4	0.06
Labor	7.9 ± 1.3	8.2 ± 4.3	0.08
Family	7.9 ± 1.3	7.7 ± 4.6	0.24
Emotional	2.1 ± 1.3	1.7 ± 4.4	0.07
Physical	5.5 ± 1.6	6.4 ± 1.6	0.0001
<i>PEPS-1</i>	121 ± 21	134 ± 21	0.0001
Nutrition	16.0 ± 3.4	16.9 ± 3.1	0.0001
Physical activity	8.2 ± 3.1	11.6 ± 3.6	0.0001
Health responsibility	21.7 ± 5.4	24.9 ± 5.9	0.0001
Stress management	15.5 ± 4.4	17.7 ± 4.4	0.0001
Interpersonal support	20.5 ± 4.2	21.4 ± 4.0	0.0001
Self-actualization	38.8 ± 7.0	41.4 ± 6.4	0.0001

\*t- test.

school children living in Tuxtla, the largest city in the state of Chiapas.<sup>26</sup> Children 5-24 months, living in urban Chiapas, had 22% possible risk of overweight, 8% of overweight, and 5% of obesity.<sup>11</sup> Additionally, among middle school children (12-15 yo) living in urban Chiapas it was observed that 19% were overweight, 13% obese, 26% had hypercholesterolemia, 7% high LDL, 10% hypertriglyceridemia, 6% high systolic blood pressure and 2% MS.<sup>26</sup> These observations were associated with formula fed infants and the introduction of high fructose drinks as well as high-fat containing snacks before 6 years of age;<sup>11</sup> conversely, among middle school children these risks were associated with eating outside the home.<sup>26</sup> The high prevalence of obesity in Chiapas is consistent with that observed among low income adults in Tijuana,<sup>8</sup> which is related to an obesigenic environment. These results indicate the importance of intervention and evaluation programs targeting the entire Mexican population to prevent obesity and MS.

To our knowledge this is the first study that implemented a social support approach to women of rural

areas, focusing on MS, self-concept, and healthy style profile. The results on the weight loss observed in this study are consistent with eight studies analyzed in a systematic review; however, those studies did not assessed all the components of MS and the AF5 and PEPS-1, and the interventions ranged from five to 24 months.<sup>16</sup> Additionally, in that review it was observed that there was heterogeneity among studies in different components, such as cultural background, period of intervention, and type of intervention.<sup>16</sup>

Although the positive results observed in this study are encouraging, the need exists to assess this intervention in different communities, with government and private resources, and in quasi-experimental approaches during longer periods of time.

The strength of this study is the high number of participants from rural areas and the high number of participants with limited or no formal education, as well as this being a population living in very poor communities in Chiapas, the Mexican state with the lowest index of human development. Furthermore, the low cost of the intervention based on the utilization of

local resources from a public university and bachelors students of nutrition and the inclusion of a social support technique focusing on changes in self-concept, lifestyles, and MS are also important strengths.

Limitations of this study include the short duration (three months) of the intervention, the wide range of the study participant's age, and the pre and posttest design.

In conclusion, SS approaches in short term interventions targeting women with low SES, low levels of education, and living in isolated, rural areas might be an affordable strategy to promote lifestyles changes, improve measurements/results in some components of MS, and reduce MS.

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## References

1. Jackson Y, Dietz WH, Sanders C et al. Summary of the 2000 Surgeon General's listening session: toward a national action plan on OW and obesity. *Obes Res* 2002; 10 (12): 1299-305.
2. Kirchengast Schober E. To be an immigrant: a risk factor for developing OW and obesity during childhood and adolescence? *J Biosoc Sci* 2006; 38 (5):695-705.
3. Paeratakul S, Lovejoy JC, Ryan DH et al. The relation of gender, race and socioeconomic status to obesity and comorbidities in a sample of U.S. adults. *Int J Obes* 2002; 26: 1205-10.
4. Lindstrom M, Sundquist K. The impact of country of birth and time in Sweden on OW and obesity. A population-based study. *Scand J Publ Health* 2005; 33 (4): 276-84.
5. McDonald JT, Kennedy S. Is migration to Canada associated with unhealthy weight gain? OW and obesity among Canada's immigrants. *Soc Sci Med* 2005; 61 (12): 2469-81.
6. Woickicki J, Shwartz N, Jimenez-Cruz A et al. Acculturation, Dietary Practices and Risk for Childhood Obesity in an Ethnically Heterogeneous Population of Latino School Children in the San Francisco Bay. *J Immigr Minor Health* 2012; 14 (4): 533-9.
7. Jiménez-Cruz A, Bacardi-Gascon M. The fattening burden of type 2 diabetes to Mexicans: projections from early growth to adulthood. *Diabetes Care* 2004; 27 (5): 1213-5.
8. Jiménez Cruz A, Castañeda González LM, Bacardí Gascón M. Poverty is the Main Environmental Factor for Obesity in a Mexican-Border City. *JHCPU* 2013; 24: 556-65.
9. Malina RM, Peña Reyes ME, Chavez GB et al. Secular change in height and weight of indigenous school children in Oaxaca, Mexico, between the 1970s and 2007. *Ann Hum Biol* 2011; 38 (6): 691-701. Epub 2011 Aug 22.
10. Sánchez-Chávez NP, Reyes-Hernández D, Reyes-Gómez U et al. Conductas para Preparar Loncheras Mediante un Programa de Intervención Educativa Sobre Nutrición con Madres de Preescolares. *Bol Clin Hosp Infant Edo Son* 2010; 27 (1): 30-4.
11. Jiménez Cruz A, Bacardí Gascón M, Pichardo Osuna A et al. Infant and Toddlers' Feeding Practices and Obesity amongst Low-income Families in Mexico. *Asia Pacific J Clin Nutr* 2010; 19 (3): 316-23.
12. OPS. Estrategia Mundial sobre Alimentación Saludable, Actividad Física y Salud, pla de implementación en América Latina y el Caribe 2006-2007. Washington, DC. [HTTP://WWW.PAHO.ORG/spanish/addpncdpas-plan-impalc.pdf](http://WWW.PAHO.ORG/spanish/addpncdpas-plan-impalc.pdf), access 02/6/2010.
13. Pérez Morales, Bacardí Gascón, Jiménez Cruz A. Childhood overweight and obesity prevention interventions among Hispanic Children: Literature Review. *Nutr Hosp* 2012; 27 (5): 1415-28.
14. Rodgers GP and Collins FS. The Next Generation of Obesity Research: No time to waste. *JAMA* 2012; 308 (11): 1095-6.
15. Latner JD, Stunkard AJ, Wilson GT et al. Effective long-term treatment of obesity: a continuing care model. *Int J Obes Relat Metab Disord* 2000; 24 (7): 893-8.
16. Paul-Ebhohimhen V, Avenell A. A Systematic Review of the Effectiveness of Group versus Individual Treatments for Adult Obesity. *Obesity Facts* 2009; 2: 17-24.
17. Flores-Gómez I, Bacardi-Gascon M, Armendáriz-Anguiano AL et al. Evidence of social support on weight loss: A systematic review. *Nutr Hosp* 2012; 27 (5): 1422-8.
18. Instituto Nacional de Estadística y Geografía (INEGI) (2000). Perfil sociodemográfico Chiapas XII Censo General de Población y Vivienda. Accessed on February 13, 2012 on <http://www3.inegi.org.mx/sistemas/mexicocifras/default.aspx>
19. García F. and Musitu G. (2009). AF5 Autoconcepto Forma 5. (pp. 1-56). Madrid: TEA Ediciones.
20. Pender NJ and Pender AR. (1996). Health promotion in nursing practice. Michigan: Appleton and Lange.
21. Secretaría de Salud (2001). Norma Oficial Mexicana NOM-030-SSA2-1999, para la prevención, tratamiento y control de la hipertensión arterial (Published on January 17<sup>th</sup>, 2001). Access on November 14<sup>th</sup>, 2010: <http://www.salud.gob.mx/unidades/cdi/nomssa.html>
22. Lohman TG, Roche AF, Martorell R (1988). Anthropometric standardization reference manual. Champaign, Illinois: Human Kinetic Books.
23. Secretaría de Salud (2000). Norma Oficial Mexicana NOM-174-SSA1-1998, para el manejo integral de la obesidad (Publicada el 12 de abril de 2000). Accessed on November 14<sup>th</sup>, 2010: <http://www.salud.gob.mx/unidades/cdi/nomssa.html>
24. Secretaría de Salud (2003). Norma Oficial Mexicana NOM-037-SSA2-2002, para la prevención, tratamiento y control de las dislipidemias (Published on June 21<sup>th</sup>, 2003). Accessed on November 14<sup>th</sup>: <http://www.salud.gob.mx/unidades/cdi/nomssa.html>
25. Secretaría de Salud (2010). Norma Oficial Mexicana NOM-015-SSA2-2010, Para la prevención, tratamiento y control de la diabetes mellitus (Published on November 23<sup>th</sup>, 2010). Accessed on September 5<sup>th</sup>, 2011: <http://www.salud.gob.mx/unidades/cdi/nomssa.html>
26. Alberti KG, Zimmet P, Shaw J. Metabolic syndrome-a new world-wide definition. A Consensus Statement from the International Diabetes Federation. *Diabet Med* 2006; 23 (5): 469-80.
27. Velasco-Martínez RM, Jiménez-Cruz A, Higuera Domínguez F et al. Obesidad y Resistencia a la Insulina en Adolescentes de Chiapas. *Nutr Hosp* 2009; 24 (2): 151-6.