

## Revisión

# The social determinants of health of the child-adolescent immigration and its influence on the nutritional status: systematic review

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### Abstract

**Objective:** to review the social determinants of health more characteristic of the child and adolescents of immigrants, by reviewing the literature and assess its effect on nutritional status.

**Methods:** a systematic review was performed using Medical Subject Headings (MeSH) in PubMed (Medline) and The Cochrane Library, in order to identify undetected studies; articles bibliographic lists were examined. The final election was done according to inclusion and exclusion criteria. No restrictions on sex and ethnicity of the participants. STROBE checkpoints were used for an information and methodological quality control. As Social Determinants of Health (SDH); social, demographic and economic conditions were considered for the study of their effect on the nutritional status.

**Results:** from 31 identified articles 18 are included in this study, 17(94,4%) had a good or excellent quality. Hispanic and African were the most studied ethnicities; birth place and parent's residence period were used for generational classification. Alimentary culture and linguistic isolation of the first generation have a protective effect preventing from overweight and obesity risk while it decrease in second and third generation due to the experienced acculturation process equalizing their weight gain to natives; which prevalence is higher among Hispanics. No relation was found for nutritional status differences between sexes neither alimentary aids protective effect hypothesis was confirmed.

**Conclusions:** the SDH with greater influence on child-adolescent immigrants were the socio-demographic conditions; among them: residence period distinguish the three identified generations while linguistic barrier and ethnic background are truly influential on the biological response to the experimented change caused by the acculturation process, establishing differences in the nutritional status.

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Key words: *Emigrants and immigrants. Nutritional status. Overweight. Obesity. Body weight changes.*

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### LOS DETERMINANTES SOCIALES DE LA INMIGRACIÓN INFANTO-JUVENIL Y SU INFLUENCIA SOBRE EL ESTADO NUTRICIONAL: REVISIÓN SISTEMÁTICA

### Resumen

**Objetivo:** revisar los determinantes sociales de la salud (DSS) más característicos de la población infantil y juvenil de inmigrantes, mediante revisión de la literatura científica y evaluar su efecto sobre el estado nutricional.

**Métodos:** Se realizó una revisión sistemática utilizando los Medical Subject Headings (MeSH) en PubMed (Medline) y The Cochrane Library, con el fin de identificar los estudios no detectados; se examinaron las listas de artículos bibliográficos. La elección final se hizo de acuerdo con los criterios de inclusión y exclusión. No hubo restricciones sobre el sexo y el origen étnico de los participantes. Se utilizaron los puntos de verificación de la guía STROBE para un control de la información y la calidad metodológica. Como Determinantes Sociales de la Salud (DSS); se consideraron las condiciones sociales, demográficas y económicas para el estudio de su efecto sobre el estado nutricional.

**Resultados:** Fueron identificados 31 artículos de los que se incluyó un total de 18 estudios, 17 (94,4%) tuvieron una buena o excelente calidad. Las etnias más estudiadas fueron la Hispana y afroamericana; para la clasificación generacional se utilizaron el lugar de nacimiento y tiempo de residencia de los padres. La cultura alimentaria y el aislamiento lingüístico de la primera generación tienen un efecto protector en la prevención de riesgo de sobrepeso y obesidad, mientras que disminuye en la segunda y tercera generación debido al proceso de aculturación experimentado igualando su aumento de peso a los nativos; la prevalencia más alta fue entre los hispanos. No se encontró relación sobre las diferencias del estado nutricional entre los sexos ni se confirmó la hipótesis del efecto protector de las ayudas alimentarias.

**Conclusiones:** los DSS con mayor influencia sobre la población joven inmigrante son las condiciones socio-demográficas; entre ellos: el tiempo de residencia distingue las tres generaciones identificadas mientras que la barrera lingüística y el origen étnico son los verdaderamente influyentes en la respuesta biológica al cambio experimentado causado por el proceso de aculturación, estableciendo así diferencias en el estado nutricional.

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Palabras clave: *Emigrantes e inmigrantes. Estado nutricional. Sobrepeso. Cambios en el peso corporal.*

## Abbreviations

MEDLINE: Medlars International Literature Online.

MeSH: Medical Subject Headings.

STROBE: Strengthening the Reporting of Observational Studies in Epidemiology.

ECLS: Early Childhood Longitudinal Study.

U.S.: Original of The United States of America.

## Introduction

The transition years between childhood and adolescence marks a critical socialization period in which the acquisition of food habits is defined by socio-economic, cultural factors and the environment<sup>1-3</sup>. In the immigrant population this relationship, according Alba & Nee<sup>4</sup>, was described from a perspective through three distinctions of the assimilation theory: sociocultural, negative and segmented.

Thus, the study of food habits in immigrants and the related changes in body weight took interest from a generational approach (child and adolescent), the differences between the two generations are considered result of the decreased effect of ethnicity on conditioning factors due to the place of socialization of each generación<sup>5,6</sup>.

In this sense, this socialization process is established by the structural determinants and living conditions, these constitute the social determinants of health. Yet at the same time are the causes of the majority of health inequalities<sup>7</sup>. Such inequalities, as child poverty, which affects 4 out of each 5 persons, and passing from one generation to another, are major obstacles in improving population health and reducing inequalities<sup>8</sup>.

At present, the figure of 1000 million people are in a "migrant" situation makes their state of health a priority of Global Public Health<sup>9</sup>.

Hence, in relation to the above, the objective of this study is to review the social determinants of health more characteristic of the child and adolescents of immigrants, by reviewing the literature and assess its effect on nutritional status.

## Materials and Methods

### *Design*

Descriptive study of the articles retrieved using systematic technique.

### *Sources of data extraction*

All data were obtained from direct consultation and access via Internet to the scientific literature contained

in the database Medlars International Literature Online (MEDLINE), via PubMed and The Cochrane Library.

### *Data processing*

We studied the articles published in any country and language.

For the recovery of evidence were used Medical Subject Headings (MeSH) developed by the U.S. National Library of Medicine. Search equations were developed for its use in the MEDLINE database via PubMed, using Boolean connectors, and in The Cochrane Library proceeding in the same way.

From the study of the Thesaurus the following descriptors were used "Emigrants and Immigrants", "Socioeconomic Factors, Cultural Characteristics, Social Class", "Nutritional Status, Overweight, Obesity, Body Mass Index, Body Weight Changes" and "Cohort Studies". "Humans" was used as a limit. Also limiting to the last 7 years (2005-2012), as the period of obsolescence (half period of Burton Kebler) established for publications in the field of health science<sup>10</sup> and nutrition<sup>11</sup>.

### *Final selection of articles*

The final election of the works was done according to the fulfillment of the inclusion and exclusion criteria.

**Inclusion criteria:** The accepted articles were those with longitudinal design of Cohorts type whose study population consisted of immigrants between 2-18 years of age. We selected original articles published in peer journals, full text of which was recovered.

**Exclusion criteria:** Articles of different design which comprised pathology cases, pregnancies and only adults.

Additionally, as a secondary search and to reduce potential publication bias, we examined the bibliographic list of articles that were selected in the main quest, in order to identify undetected studies in bibliographic databases.

For quality control of information were used the 22 checkpoints of the guide "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) based on the 4 items (8, 13 to 15 checkpoints) specific for the methodological quality of cohort studies<sup>12</sup>.

To determine the pertinence of the articles were assessed independently by two of the authors of this review (K C-M and J S-V). To give as valid the election of the articles selected for the review it was established the assessment of the concordance between these two authors (kappa index) which should be greater than 0.60 (strength of agreement was good or very good). As long as this condition is fulfilled, any discrepancies are solved by consulting the third author (C W-B) and subsequent consensus among all authors.

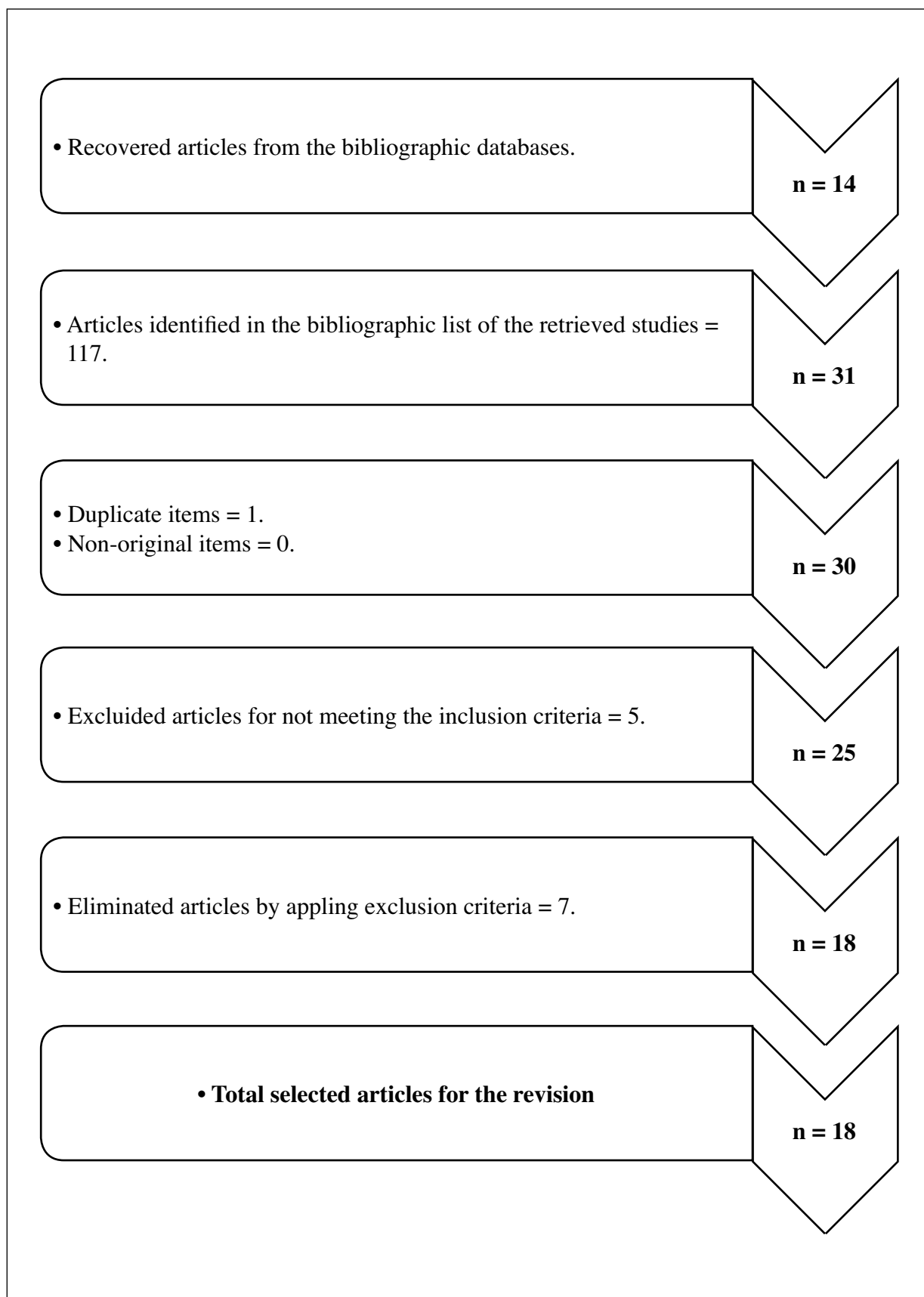


Fig. 1.—Chart for the selection of articles.

## Data extraction

Studies were grouped according to study the variables in order to systematize and facilitate the understanding of the results of all reviewed articles. There were no restrictions on sex and ethnicity of the participants. And were summarized in a table, codifying: authors, year of publication, population under study, ethnicity, immigrant generation, carried intervention, follow-up period, where the intervention took place and the main conclusions indicated in the reviewed articles.

Social determinants of health that are considered to assess its scope on the nutritional status were those of social and demographic kind (ethnicity, race, country of birth, number of years resided in the host country, number of siblings, parents' educational level, linguistic and social integration) as well as the economics (occupation of the primary caregiver, family income and the type of school).

## Results

A total of 14 articles were recovered from MEDLINE while not getting results from The Cochrane Library database. From the bibliographic list of the reviewed articles 18 works were identified.

Five works didn't meet the inclusion criteria by considering a different issue. Nine studies which population wasn't immigrant children and adolescent were eliminated or their principal objective wasn't the study of the effect on population's nutritional status but the prevention of diseases (cardiovascular diseases, diabetes, cancer, etc.). Thus, after applying the inclusion and exclusion criteria, 18 studies were selected<sup>13-30</sup>; see Table I.

The agreement about the quality of the studies between the authors was 100%. Of the selected articles 10 (55,5%)<sup>13-15, 17, 19, 24-26, 29</sup> considered all the quality variables while 8 (44,4%) studies<sup>16, 18, 20-23, 27, 30</sup> included 90-95% of them. Despite this, 17 (94,4%) articles<sup>13-29</sup> had a good or excellent quality; see Table II.

Of the 18 interventions, 12 (66,6%)<sup>13, 15-17, 19, 21-24, 27-29</sup> took place in United States of America while the 6 (33,3%) left were in Canada<sup>14, 30</sup>, Australia<sup>20, 26</sup>, Austria<sup>18</sup> and Denmark<sup>25</sup>. The period of study for 17 (94%) articles was between 4 and 6 years, and 2 years for the rest<sup>25</sup>. The places where the interventions have been carried out were mainly the family residence<sup>14-17, 20-22, 26-28</sup> and/or educational centers<sup>13, 18, 30</sup>.

The most used instruments for the intervention were the anthropometric measures<sup>13-17, 21, 23-27, 30</sup>, the surveys<sup>14, 16, 17, 19, 21, 22, 27, 28</sup>, the questionnaires on socioeconomic status<sup>15, 16, 25</sup> and demographic characteristics<sup>13, 21, 23, 27-30</sup> (a detailed description of these and of the principal objective of each study are provided in Table III).

Varied information was found about the subjected population, the most studied ethnicity background was the Hispanic<sup>14, 17, 23, 27, 30</sup> followed by the African<sup>16, 22, 28, 29</sup>, the place of birth was mainly used for the generational classification<sup>13, 17, 18, 22, 24-28, 30</sup>, followed by the years of residence of the parents<sup>20, 21, 23, 29</sup>. The intervention with the largest number of individuals had n=20745<sup>28</sup> and the smallest had n=210 persons<sup>14</sup>.

Most studies<sup>13, 17, 18, 20-22, 24, 26-30</sup> show that the coexisting social conditions between the three identified generations produce differences in their nutritional status, highlighting the protective effect of the immigrant status of the first generation, characterized by the alimentary culture and the linguistic isolation, which protect them from the risk of overweight or obesity<sup>17, 21, 28-30</sup> while in the case of the second and third generation their weight gain get equalized to the native population due to the adaptation or acculturation process<sup>13, 17, 21, 28-30</sup>.

The prevalence of overweight and later obesity was higher in Hispanic individuals compared to the native population of the studied country<sup>17, 19, 22, 28</sup>. No relation was found in the study of nutritional status differences between sexes. Neither was confirmed the hypothesis that the access to alimentary aids protects the individuals from malnutrition or overweight/obesity.

## Discussion

As has been observed, the most part of the studies took place in The United States of America probably due to the immigration population of this country which comprises 40.377.757 persons (Data was obtained from the emigration database of The Migration Policy Institute of USA, <http://www.migrationinformation.org/datahub/countrydata/country.cfm>) and because historically has been under study (Early Childhood Longitudinal Study, ECLS Study - <http://nces.ed.gov/ecls/>).

The use of the familiar residence as the principal place of intervention is due to the easy access to the family data from mothers. Also, the school center was an optimal place for collecting information from children<sup>26, 30, 31</sup>. The use of the surveys-in-home provided continuity for information collection to define the ethnic profile and the social status, as well as the questionnaires referred to alimentation, origin country, familiar characteristics and incomes.

Some U.S. studies<sup>13, 16, 19, 21, 22, 28, 29</sup> observed several ethnic origins being the Hispanic the most studied due to the heterogeneity within this ethnic group and to its massive immigration to the host country<sup>24, 27</sup>.

The exclusive election of cohort studies could be considered a limitation but its design generates a large amount of inputs due to its long-time term in comparison to the observational studies of cross-sectional and case-control design<sup>12</sup>. Another possible limitation of this revision is the exclusion of studies about adult population for which there is a larger number of arti-

**Table I**  
*Resume of the reviewed articles about the scope of the social determinants of health on the nutritional status of the child-adolescent generations of immigrants.*

Author	Year	Population	Generational classification	Ethnic origin	Intervention	Period	place	Principal Conclusions
Popkin BM M. et al. <sup>13</sup>	1997	$\eta$ : 14438 $M$ : %49.1 $F$ : %50.1 $\chi$ Age: 13-18 (8646)	1 <sup>st</sup> G Ch.Ps-FB 2 <sup>nd</sup> G IP-FB 3 <sup>rd</sup> G Ps-NB 3 <sup>rd</sup> +G gPs-FB	%53.5 NoHs-Wh %21.8 NoHs-B %0.8 NoHs-AI %15.7Hs %6.8 As	AntrpMe. Intv-Ad. Re-intv(2y). q-inSch. qPs.	4 y.	USA	Among ethnicities, $\sigma$ are more OB than $\varphi$ except $\sigma$ with Non-Hisp-B ethnicity. The $\sigma$ -Adols 13-15y suffer +OB and have $\downarrow$ OB at 16-18y than $\varphi$ . Only in Hispanics & Asian ethnicity the 1st G is $\downarrow$ OB than 2&3+G affected by acculturation.
O'Loughlin J et al. <sup>14</sup>	1998	$\eta$ : 210 $M$ : %46.9 $F$ : %47.2 $\chi$ Age: 10.8	<%25 %25-49 %50-74 %75-99 %100 (Rsy/Age)	%15.8 As. %5.2 Ar %24.2 C-S Am. %23.8 EU. %21.7 Canada.	Antrp-Me svInH-Ad. svinH-Ps.	5 y.	Canada	The ethnic origin, the length of stay in host country, Ps BMI (Parents) condition students overweight and obesity in early age.
Suminski RR et al. <sup>15</sup>	1999	$\eta$ : 1127 $M$ : 587 $F$ : 540 $\chi$ Age: 8.0	Academic year: K/ First /Second Fourth/ Fifth	Mx-Am	AntrpMe. PsRe.	6 y.	USA	The received food aids by 5.5 years obese children in kindergarten course didn't reduce the OB p after 5 years of monitoring, reaching an average 91% of children aged 9.5-10.5 years from both sexes.
Gordon Larsen P et al. <sup>16</sup>	2003	$\eta$ : 13,113 $M$ : %53.5 $F$ : %46.5 $\chi$ Age: 16.0	Hs Wh Af-Am As	%54.4 NoHs-Wh %21.3 AfAm %17.2 Hs %7.0 As	Antrp-Me. svInH-Ad. svinH-Ps.	4 y.	USA	The pOW is $\uparrow$ in Af-Am $\varphi$ followed by Hs $\neq$ to As $\sigma$ + $\varphi$ related to their SES and parent's education level. Equalizing these 2 factors, the differences increase among the 4 ethnicities, with a $\uparrow$ pOW in Af-Am group.
Gordon Larsen P et al. <sup>17</sup>	2003	$\eta$ : 8613 $M$ : %50.5 $F$ : %49.5 $\chi$ Age: 15.93	1 <sup>st</sup> G Ps-FB 2 <sup>nd</sup> G IP-FB 3 <sup>rd</sup> G Ps-NB	%78.1Wh %13.4 Mx %4.6 PR %3.9 Cb	AntrpMe. svInH-Ad. svinH-Ps.	4 y.	USA	Between 4 ethnicities the 1st G is related to poor structural characteristics, comparing the 3G there is a $\uparrow$ OW in 2nd and 3rd G while in relation to these characteristics and acculturation ones it is $\uparrow$ in all G of Mx and Cb.
Kirchengast S et al. <sup>18</sup>	2005	$\eta$ : 1909 $M$ : %- $F$ : %- Age: 6-15 y.	1 <sup>st</sup> G Ps-FB 2 <sup>nd</sup> G IP-FB 3 <sup>rd</sup> G Ps-NB	437 Tuk 555 Yu 794 Ast	AntrpMe. SES-Sch.	4 y.	Austria	In Mig $\varphi$ there is $\uparrow$ p OW&OB compared to the Ast. Among $\sigma$ the p is $\uparrow$ in Yu children (10y). In puberty (15y) the Tuk Ch&Adols have $\uparrow$ OW&OB risk than their homologues.
Whitaker R et al. <sup>19</sup>	2006	$\eta$ : 2452 $M$ : $F$ : $\chi$ Age: 3	Wh. Bk. Hs. Ot.	NoHs-Wh NoHs-Bk Hs (any race) Ot race, No-Hs	AntrpMe. PsRe-Fy\$. Re-M.Edc. svFdSec.	3 y.	USA	Among ethnicities the p OB is higher in Hispanic with a 1/4 of them OB. No moderate effect was shown for the 3 SES factors (M.Edc/Fy\$/FdSec) on OB between ethnic groups.
Renazho A et al. <sup>20</sup>	2006	$\eta$ : 337 $M$ : %49.0 $F$ : %51.0 Age: 3-12 y.	$\leq$ 1 yrs 1-5 yrs 6-10 yrs $\geq$ 11 yrs	%18.7 C-Af. %70.9 Est/Sth-Af. %10.4 Wess-Af.	AntrpMe. PsRe-Fy\$. Re-Ps.Edc. PsRe-LOS.	-	Aus	$\sigma$ residing < than 1 year present a $\uparrow$ p de undernutrition while is inversely related to a $\uparrow$ length of stay. Among ethnicities, Western African children are more likely to be OW&OB compared to other ethnicities.

**Tabla I (cont.)**

Resume of the reviewed articles about the scope of the social determinants of health on the nutritional status of the child-adolescent generations of immigrants.

Author	Year	Population	Generational classification	Ethnic origin	Intervention	Period	place	Principal Conclusions
Van Hook J et al. <sup>21</sup>	2007	n: 16664 M: % F: % χ Age: -	-G1.0(Ps 12yrs<) -G1.5(Ps 0-11yrs) -Ch-NtPs	Hs. As. Pef Islander.	Antrp-Me. Intv-M. qPs. svSchEnv. svSES.	6 y.	USA	The SES affects in a lesser degree on the ↑ of BMI in the G1.0 while it is ≈ in G1.5 and NtPs. But a ↓GDP/c of the CB ↑ the BMIB in the G1.5 ≠ to G1.0 whereas to a ↑ GDP/c a ↓ BMIB/G is present in both.
Kalil A et al. <sup>22</sup>	2008	n: 6068 M: %51.5 F: %48.5 Age: 6 y.	Ch/ Ps FB.Nct-M Ch/Ps FB.USct-M IPs-FB.Nct-M IPs-FB-USct-M Ps-NB	%57.7 Wh. %18.9 Lt. %16.0 AfAm. %4.6 Ot.	qFCs. svinH-Ps.	4 y.	USA	Among immigrants: being Ch-FB.Nct-M, Latine, from a large family and with low incomes have a higher probability to be food insecure (FInsec). Between natives and immigrants: Ch-FB.Nct-M suffers doble FInsec than Ch-FB.USct-M. The access to food aids doesn't decrease the big ≠ in FInsec between them.
Rosas LG et al. <sup>23</sup>	2009	n: 374 M: %47 F: %52.9 χ Age: 5	M.Mx-RsMx M.Mx-RsCA-US: 5-10 yrs. 11-15 yrs. 16< yrs.	%20 Guanajuato. %12 Jalisco. %24 Michoacán.	Med-Antrp. qSES qSupl.	5 y.	USA Mexico	Residing >10 years in the USA, the mother's obesity and underestimate their children actual weight increase significantly their risk to OW and OB, in contrast to the Mx population.
Balistreri KS et al. <sup>24</sup>	2009	n: 12696 M: %51.5 F: %48.5 Age: 5-7	WhCh-Nt Ps. HsCh-Mig Ps. HsCh-Nt Ps.	%69 Mx. %9 PR. %3 Cb. %19 Ot Hs.	Antrp-Me qSES.	6 y.	USA	Two SES indicators as incomes and Ps education level ↑ the child's IMC in the case of HsCh-Mig Ps, this effect doesn't maintain from an ethnic approach.
Teilmann G et al. <sup>25</sup>	2009	n: 276 M: %0 F: %100 Age: 4-13	Edad Adopción: <2 yrs >2 yrs NB-Denmark	%35.8 Hindú. %13.8 S-Corea. %29 Ot As. %13.8 S-Am %5.4 E-EU %1.8 Af.	Antrp-Me	2 y.	Denmk	The weight, height and BMI in childhood are ↓ in adopted ♀ compared to natives but in earlier puberty the Antrp-Me are approximate between both groups. In full pubertal age, adopted ♀ have ↑ BMI than girls of Danish origin.
Renzaho A et al. <sup>26</sup>	2009	n: 4983 M: %50.9 F: %49.1 χ Age: 4.9	PC-Bplace: Aus/EU/As/Ot Ch-L.s-Home: %12.5 No-Eng %87.5 Eng only	PC-Bplace: %75.2 Aus. %3.7 N-Z/Pcf %5.8 UK/Ir. %1.8 Ot EU. %7.2 As %6.3 Ot.	Antrp-Me. Intv-PC.	6 y.	Aus	PC-(UK/Ireland) children, who use English as L.s-Home, are less probable to be OW/OB than PC-Aus children who use a ≠L.s-Home to English. The prevalence of thinness is higher in PC-(N-Z/Ind/pacific) and PC-Asia children.

**Table I (cont.)**

Resume of the reviewed articles about the scope of the social determinants of health on the nutritional status of the child-adolescent generations of immigrants.

Author	Year	Population	Generational classification	Ethnic origin	Intervention	Period	place	Principal Conclusions
Baker B et al. <sup>27</sup>	2009	η: 4360 M: %- F: %- χ Age: 10	HsCh-MigPs HsCh-NtPs NoHs-Wh	%69 Mx. %9 PR. %3 Cb. %19 Ot Hs.	Antrp-Me. qFCs. svMep. qCBPs. PsRe(Fy\$TVt)	6 y.	USA	Mep impact on BMI-Ch changes by the Fy\$ and the ethnicity/nativity state. At ↑ Fy\$, Mep prevents Ch-MigPs from OW while at ↓ Fy\$ the effect of Mep on Ch-NtPs and WhCh BMI is lower.
Mullan Harris K et al. <sup>28</sup>	2010	η: 20 745 M: %51,43 F: %48,57 Age: 11-18	1 <sup>st</sup> G Ad.Ps-FB 2 <sup>nd</sup> G Ad.US.Ps-FB 3 <sup>rd</sup> +G Ad.Ps-NB	%15.8 Bk. %12.0 Hs. %4.3 As. %67.9 Wh.	svInH-Ad. Intrv-Ad.	4 y.	USA	Among generations: the initial and growth BMI is ↓ for the 1rstG ≠ to the 2nd y 3rd G, while among the 4 races, the Hs and Bk have higher gain of BMI. Between sexes: ♀ tend to gain more BMI than ♂ during adolescence.
Van.Hook J et al. <sup>29</sup>	2010	η: 20150 M: %- F: %- χ Age: -	-G1.0(Ps 12yrs<) -G1.5(Ps 0-11yrs) -Ch-NtPs	%17 Bk. %14 Hs. %3 As. %67 Wh.	AntrpMe. Intv-M. En-Ps.PFMC.	6 y.	USA	Acculturation measured by: <b>Socialization place:</b> Ch-G1.0 ♂ W+ than Ch-G1.5 and Ch-NtPs. Within the ethnic groups, ♀ gain less W than ♂ of G1.0 y G1.5. <b>Social isolation:</b> ♂ of G1.0 who have a ↓En-Ps.PFMC present ↓BMIB/G.
Maximova K et al. <sup>30</sup>	2011	η: 6392 M: %50.6 F: %49.4 χ Age: 11.2	1 <sup>st</sup> G Ps-FB 2 <sup>nd</sup> G 1P-FB 3 <sup>rd</sup> G Ps-NB	%17.8 As. %27.3 C-S Am. %19.9 EU. %17.4 Ot.	Antrp-Me q-insch	4 y.	Canada	The length of stay in the host country ↑ the exposition to unhealthy habits concluding in a ↑BMI (2nd and 3rd generation ≠ to the 1rst).

#: Different. <: Less than. ≈: nearly/approximate. ↑: high. ↓: Fewer. η: Total number of persons. p: prevalence. F: Female. M: Male. ♀: women/girls. ♂: men/boys. χAge: mean age.  
Adols: Adolescents. BMI(IMC): Body mass index. BMI<sub>perc</sub>: Basal/Growth body mass index. OB: Obesity. OW: overweight. W: weight. G: Generation. G1.0Ps (12yrs<): generation 1.0 represents parents who arrived with 12 years. G1.5 (Ps 0-11yrs): generation 1.5 represents parents who arrived between 0-11 years. CB: country birth. GDP: gross domestic product. Hs: Spanish. As: Asian. S-Corea: South-Corea. Ar: Arabian. C-S Am: Central-South America. EU: European. E-EU: East-European. AfAm: African-American. C-Af: Central-Africa. Est/Sth-Af: East/South Africa. Wes-Af: Western Africa. Pef Islander: Pacific Islander. Aus: Australia. N-Z/Pef: New Zealand/Pacific. UK/Ir: United Kingdom/Ireland. Mx: Mexican. Mx-Am: Mexican-American. M.Mx-RsMx: Mexican mother-resident in Mexico. M.Mx-RsCA-US: Mexican mother-resident in California, USA. PR: Puerto Rican. Cb: Cuban. K: Kindergarten. Tuk: Turkish. Yu: Yugoslavian. Ast: Austrian. Lt: Latin. Ot: Other. Rsy/Age: Total years of residence/ age at the moment. LOS: Length of stay. PC-Bplace: Primer carer-Birth place. Ch-L-s-Home: Child-language speak-home. Ch/Ad.Ps-FB: Child/ Adolescent and parents are foreign-born. Ch-NtPs: Child with native parents. Ch/PsFB: Child/Parents Foreign-born and(Nct-M): Non-citizen-mother. and(Nct-M): Citizen Mother of the USA. Ad.US.Ps-FB: USA native adolescent with foreign born parents. Ad.Ps-NB: Adolescent and parents are foreign born. 1P-FB: one of both parents is foreign-born. and(Nct-M): Non-citizen-mother. and(Nct-M): Citizen mother of the USA. Ps-NB: Parents are native-born. NoHs-Wh: White not Spanish. NoHs-B: Black not Spanish. NoHs-AI: American-Indian not Spanish. WhCh-Nt Ps: White child-native parents. HsCh-Nt Ps: Spanish child-native parents. HsCh-Mig Ps: Spanish child-migrant parents. Check the interventions abbreviations in Table III.

**Table II**  
*Analysis of the studies methodological quality through the 22 assessment points of the STROBE guide<sup>12</sup>.*

Articles/ Points	#1	#2	#3	#4	#5	#6	#7	#8*	#9	#10	#11	#12	#13*	#14*	#15*	#16	#17	#18	#19	#20	#21	#22	Total	
Popkin BM et al. <sup>13</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(14)
O'Loughlin J et al. <sup>14</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(16)
Suminski RR et al. <sup>15</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(15)
Gordon Larsen P et al. <sup>16</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	20(16)
Gordon Larsen P et al. <sup>17</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(17)
Kirchengast S et al. <sup>18</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	21(15)
Whitaker et al. <sup>19</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(17)
Renazho A et al. <sup>20</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	21(16)
Van Hook J et al. <sup>21</sup>	█	█	█	█	█	█	█	█	█	▫	█	█	█	█	█	█	█	█	█	█	█	█	█	21(18)
Kalil A et al. <sup>22</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	20(16)
Rosas LG et al. <sup>23</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	21(16)
Balistreri KS et al. <sup>24</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(16)
Teilman G et al. <sup>25</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(16)
Renzaho A et al. <sup>26</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(18)
Baker B et al. <sup>27</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	21(16)
Mullan Harris K et al. <sup>28</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(14)
Van.Hook J et al. <sup>29</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	22(16)
Maximova K et al. <sup>30</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	20(13)

█ Completely meet the assessment points including the sub-points. █ Meet the assessment point and part of its sub-points. ▫ Don't meet the assessment point or its sub-points. ( ) Number of verification points totally completed. \* Specific quality verification points for cohort studies.



**Tabla III**  
Objective and description of the intervention realized in the reviewed studies.

<i>Author/year</i>	<i>Objective</i>	<i>Intervention Description</i>
Popkin BM et al. <sup>13</sup> 1997	Explain the underlying conditions of adolescent health and health behavior with special emphasis on the effects of the multiple contexts of adolescent life	<b>Intrv-Ad Re-Intv(2y).</b> (AntrpMe). Adolescents interview for: weight (Kg) y height (m). Repeated 2 years later. <b>qInSch.</b> Questionnaire in school for participant's election. <b>qPs.</b> Parents questionnaire: Ethnicity and race data.
O'Loughlin J et al. <sup>14</sup> 1998	Increased understanding of the early determinants of obesity is essential because of the increasing prevalence of obesity in many industrialized countries.	<b>Antrp-Me.</b> 2 measures of weight (Kg) and height (m). <b>svInH-Ad. svInH-Ps.</b> Survey and interview to parents and children for SDE data.
Suminski RR et al. <sup>15</sup> 1999	To describe the problem of obesity in Mexican American children and provide a method for identifying Mexican American children at risk for obesity.	<b>AntrpMe.</b> Measures of weight (Kg) and height (m) in school. <b>PsRe.</b> Parents report about: age, ethnicity, eating patterns, access to aids for school meals.
Gordon Larsen P et al. <sup>16</sup> 2003	To examine the extent to which race/ethnic differences in income and education account for sex-specific disparities in overweight prevalence in white, African American, Hispanic, and Asian U.S. teens.	<b>Antrp-Me.</b> BMI: measure of weight (Kg) and height (m). <b>svInH-Ad. svInH-Ps.</b> Survey to parents and children about: ethnicity/race, familiar incomes and education level data.
Gordon Larsen P et al. <sup>17</sup> 2003	Explore mechanisms that may explain the overweight differential across immigrant generations among three large subpopulations of Hispanic (Mexican, Puerto Rican, and Cuban) youth in the US.	<b>AntrpMe.</b> Measures of weight (Kg) and height (m). <b>svInH-Ad. svInH-Ps.</b> Survey in home about: structural and acculturation characteristics. A week report about: eating patterns and physical activity.
Kirchengast S et al. <sup>18</sup> 2005	Analyze the prevalence of overweight and obesity among migrant children and adolescents in Vienna, Austria, by comparing the weight status of Turkish and Yugoslavian children/adolescents with their Austrian counterparts.	<b>AntrpMe.</b> 2measures of weight (Kg) and height (m) at 6 and 10 years. <b>SES-Sch.</b> SES classification by: type of school (public or private).
Whitaker R et al. <sup>19</sup> 2006	To determine whether there are racial/ ethnic differences in the prevalence of obesity among preschool children and to determine whether these differences are explained by socioeconomic factors.	<b>AntrpMe.</b> Measures of weight (Kg) and height (m). Ethnic origin of parents collected in familiar residence. <b>PsRe-Fy\$, Re-M.Edc.</b> Mothers report about: Familiar incomes and mother's education level. <b>svFdSec.</b> Survey of 18 items about: family food security.
Renazho A et al. <sup>20</sup> 2006	Assess the anthropometric status of migrant/refugee children from sub-Saharan Africa. It is postulated that the population of migrant/refugee in Australia from SSA exhibit a mixture of undernutrition and obesity with undernutrition being related to shorter time in Australia and obesity to a longer length of stay.	<b>AntrpMe.</b> Classification of Nutritional-Status by: measures of weight (Kg) and height (m). <b>PsRe-Fy\$.</b> Parents reports about: their occupation and familiar incomes. <b>Re-Ps.Edc.</b> Parents reports about: education level and number of siblings <b>PsRe-LOS.</b> Parents reports about: Length of stay.
Van Hook J et al. <sup>21</sup> 2007	Examined socioeconomic status (SES) and economic development of the sending country as additional factors influencing children body mass index (BMI) and as moderating the relationship between parental generational status and BMI.	<b>Antrp-Me.</b> BMI: measure of weight (Kg) and height (m). <b>Intv-M.</b> Mother's interview about: family residence and birthplace. <b>qPs.</b> Parent's questionnaire: family characteristics. <b>svSES.</b> Survey for socioeconomic SES data. <b>svSchEnv</b> Survey about scholar environment.

**Tabla III (cont.)**

*Objective and description of the intervention realized in the reviewed studies.*

<i>Author/year</i>	<i>Objective</i>	<i>Intervention Description</i>
Kalil A et al. <sup>22</sup> 2008	Explain the differential rates of food insecurity between low-income native and immigrant populations, in particular, the key factors that explain differences in rates of food insecurity among the children of immigrant noncitizens, children of immigrant citizens, and children of natives.	<b>qFCs.</b> Hunger and food security in home: scarcity, quality, quantity of food and daily intakes. <b>svInH-Ps.</b> Parent's in home survey: birthplace, nationality, occupation, education, mother's emotion state and dedication to childcare. Child's race. Familiar's incomes and participation in free scholar meal program.
Rosas LG et al. <sup>23</sup> 2009	Examine and compare mothers' perception of weight in Mexico (MX) and in an immigrant community in California (CA).	<b>Med-Antrp.</b> BMI: measure of weight (Kg) and height (m) of children. <b>qSES.</b> Two questionnaires for SES data. <b>qSupl.</b> Mother's perception of her child Weight using Collins scale.
Balistreri KS et al. <sup>24</sup> 2009	Examine how Hispanic parents' income and education, combined with their nativity status (St-Nt), influenced the body mass index (BMI) of their children, compared with non-Hispanic White children (W-Ch) and their parents (Ch-Ps).	<b>Antrp-Me.</b> measure of weight (Kg) and height (m). <b>qSES.</b> Questionnaire about parent's education and familiar's incomes.
Teilmann G et al. <sup>25</sup> 2009	Study the possible effects on pubertal maturation of birth weight, age at adoption and region of origin.	<b>Med-Antrp.</b> BMI: measure of weight (Kg) and height (m) of children.
Renzaho A et al. <sup>26</sup> 2009	Examined the relationship between childhood nutritional status and ethnicity in a nationally representative sample of 4- to 5-year-old children, comprised of diverse ethnic and cultural backgrounds.	<b>Intv-PC.</b> Interview: 2,5 h, to the primary carer about SED-c: primary carer's birthplace, age, educational attainment, gender, partner, main language spoken at home, total incomes, number of siblings.
Baker B et al. <sup>27</sup> 2009	Examines the relationship between maternal employment and child overweight among fifth grade Hispanic and non-Hispanic white children.	<b>Antrp-Me.</b> BMI: measure of weight (Kg) and height (m). <b>qFCs.</b> Food frequency questionnaire for children. <b>svMep.</b> Survey about mother employment. <b>qCBPs.</b> Questionnaire about parents birthplace. <b>PsRe(Fy\$TVt).</b> Parent's report about: familiar incomes and time dedicated by children for TV.
Mullan Harris K et al. <sup>28</sup> 2009	Estimate the pattern of change of BMI through adolescence and it's extending through the transition to adulthood by examining the differences by race, ethnicity and immigrant generation and gender.	<b>Intrv-Ad Re-Intv(2y).</b> (AntrpMe). Adolescents interview for: weight (Kg) and height (m). Repeated 2 years later. <b>q-inSch.</b> Questionnaire in school to choose participants. <b>SvInH-Ad.</b> Survey in home about: race, ethnicity.
Van.Hook J et al. <sup>29</sup> 2010	Explain the degree of impact of generational status and gender inequalities in weight gain through two different dimensions of acculturation, the place of socialization and the level of integration in the host country.	<b>AntrpMe.</b> Measures of weight (Kg) and height (m). <b>Intv-M.</b> Interview to mothers: birthplace. <b>En-Ps.</b> PFMC Capacity of performance in English: Determine the degree of integration of family members in the host country.
Maximova K et al. <sup>30</sup> 2011	Determine if the rate of increase in body mass index (BMI) differs between 1 <sup>st</sup> generation; 2 <sup>nd</sup> generation immigrant children and native-born children, and if the rate of increase varies across ethnic groups.	<b>Antrp-Me.</b> 3 measures of weight (Kg) and height (m). <b>q-inSch:</b> questionnaire in school for socio-demographic data (SDE): spoken languages, student, father and mother's birthplace, period of residence in Canada and current employment of parents.

↑: high, ↓: Fewer. †: Total number of persons. **BMI(IMC):** Body mass index **OB:** Obesity. **OW:** overweight. **SES:** socioeconomic status. **Ps:** parents. **KG-Ch:** Child's actual weight.

**Percp-M:** mother's perception. **M.Mx-R(Mx):** Mexican mothers with residence in Mexico. **M.Mx-R(CA-USA):** Mexican mothers with residence in California, USA. **St-Nt:** Nativity Status. **IMC-Hisp-Ch:** body mass index of Spanish child. **W-Ch:** Child's weight. **Ch-Ps:** Child's parents. **Nut& PhyAc:** nutritional status and physical activity.

cles. Nevertheless, this age range is considered the stage of “consequences” because before reaching it is in the childhood and teenage when there is an increasing susceptibility to environmental modulator factors (socioeconomics and demographics) producing changes that are transferred to adulthood in worse outcomes<sup>28</sup>.

Although no revisions were found that specifically address about the effect of the social determinants on the nutritional status of the young generations of immigrants, Misra et al.<sup>31</sup> focuses on the study of obesity prevalence and metabolic syndrome in socially vulnerable persons and migrants from rural areas to cities of a same territory and the development of cardiovascular diseases and diabetes mellitus type II. Another article, included in this study, Renzaho et al.<sup>26</sup>, addresses the relation between the nutritional status in childhood and the ethnicity in a representative sample of children aged 5 years from different cultural and ethnic backgrounds, finding the same results as Suminski et al.<sup>15</sup> and other authors<sup>26, 27, 29</sup>, concluding that there is a higher probability of body weight changes for Hispanics who belong to a family with a high proportion of overweight/obesity and there is less weight gain among girls of any ethnicity.

The social determinants of health with greater influence on the child-adolescent immigrants were the socio-demographic conditions; among them: the period of residence distinguish the three identified generations<sup>13, 20</sup> within the studies while the linguistic barrier and the ethnic background are truly influential on the biological response to the experimented change caused by the acculturation process, establishing differences in the nutritional status<sup>26</sup>.

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