Annals of Epidemiology 24 (2014) 424–431

Contents lists available at ScienceDirect

Annals of Epidemiology

journal homepage: www.annalsofepidemiology.org

Original article

The immigration effect on obesity and overweight in Israeli Jewish male adolescents born 1970–1993

Chanan Meydan BSc Med [a,*], Gilad Twig MD, PhD [b,c,d], Estela Derazne MSc [a,c], Dorit Tzur MBA [c], Barak Gordon MD, MHA [a,c], Ari Shamiss MD, MPA [a,e], Arnon Afek MD, MHA [a,e,f]

[a] Sackler Faculty of Medicine, Tel Aviv University, Israel
[b] Department of Internal Medicine B, Sheba Medical Center, Ramat Gan, Israel
[c] Israeli Defense Forces Medical Corps, Ramat Gan, Israel
[d] The Pinchas Borenstein Talpiot Medical Leadership Program, Sheba Medical Center, Ramat Gan, Israel
[e] Sheba Medical Center, Ramat Gan, Israel
[f] Department of Management, Bar Ilan University, Ramat Gan, Israel

ARTICLE INFO

Article history:
Received 12 August 2013
Accepted 5 February 2014
Available online 3 March 2014

Keywords:
Adolescent
Obesity
Overweight
Emigration and immigration

ABSTRACT

Purpose: The aim of the study was to assess the relationship between age of arrival of male pediatric immigrant populations in Israel and their risk for subsequent high-weight morbidity at adolescence.
Methods: The study analyzed a pooled cross section of 89,744 foreign-born male Jewish study participants, who were born in the former Soviet Union or Ethiopia (1970–1993) and immigrated in childhood to Israel. Each participant's body mass index was measured at approximately 17 years of age. Odds ratios were calculated for obesity and overweight according to age on arrival to Israel. A total of 52,503 Israel-born participants with origins in those same countries were measured at the same age and used as references. A total of 52,258 native Israelis without known immigrating ancestry were also used for comparison. The risk stratification accounted for possible socio-demographic confounders and birth year.
Results: Foreign-born immigrants had decreased risk for obesity and overweight relative to Israeli-born immigrants when measured at the age of 17 years. However, those who arrived in Israel during infancy and early childhood (before the age of 3 years) had greater risk for high weight compared with those immigrating during late childhood and adolescence.
Conclusions: Although generally protective against obesity and overweight relative to native, these beneficial effects of immigration are diminished for those arriving in early childhood rather than later in adolescence.

Introduction

Body weight has been studied extensively in the past regarding its effect over morbidity and mortality, especially in the cardiovascular spectrum [1]. There is evidence in existing research that among other factors, immigration also modifies risk for cardiovascular diseases, including coronary heart disease and diabetes mellitus [2,3]. The body mass index (BMI) profile of some immigrant populations, including adolescents [2,4–6], was found to change after residence in the host society. A "healthy immigrant effect" has been described in immigration across countries, in which newly arrived immigrants enjoy better health than the native population but lose this advantage with the duration of stay. In the United States, for example, a pooled analysis showed that longer residence of immigrants resulted in higher prevalence of hyperlipidemia and obesity with ethnicity as a risk modifier for such trajectories [7–10]. The same effect has also been observed in children and adolescents [11,12]. This so-called "acculturation" of immigration populations is considered obscure by researchers as to its precise socio-biological mechanisms and degree of relevance among different ethnic-immigrant populations.

Israel has gathered throughout its history several populations from different origins across the globe. This includes survivors of the Holocaust from Europe in the 1940s and 1950s, Asian and African populations that immigrated mainly during the 1950s and 1960s, people from the former Soviet Union (USSR) and Eastern Bloc who came in large numbers beginning in the 1970s, and population from Ethiopia beginning in the 1980s. Healthwise there

Conflicts of interest: The authors report no conflict of interest regarding the study.

* Corresponding author. Sackler Faculty of Medicine, Tel Aviv University, Israel. Tel.: +972-54-4260684; fax: +972-3-6409103.
E-mail address: chananme@post.tau.ac.il (C. Meydan).

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http://dx.doi.org/10.1016/j.annepidem.2014.02.012

is evidence that some of these populations have modified their morbidity profile. The Jewish population that originated in Yemen increased its rate of diabetes mellitus from almost nonexistence to approximately 12% in a follow-up of 25 years [13–15]. The same cohort also showed increased blood lipids on follow-up versus time of arrival even in nondiabetics [15]. Studies showed a sharp rise in the prevalence of diabetes in members of the Israeli Jewish Ethiopian community as well [15,16]. Apart from these specific trends in discrete communities, a general surge of obesity and overweight is evident in Israeli youth with estimates of 6% obesity and 17% overweight for 17-year-old males born in 1993 [17].

The goal of present study, as part of continuing research conducted previously by our group about population-based trends in obesity [17], was to explore the association of age at immigration with high-weight status in immigrant populations that arrived in Israel in childhood. This was achieved through a multiyear pooled cross-section of boys who were measured for weight and height by professionals at the age of approximately 17 years. Foreign-born immigrants were compared with Israeli-born reference groups, all born between 1970 and 1993. The study was meant to augment existing research in the question of acculturation, "healthy immigrant effect," and the influence of environmental changes at young age on weight. We compared two Jewish Israeli immigrant populations from the USSR and Ethiopia, which formed the bulk of immigration to Israel in the 1970s, 1980s, and 1990s. We included these specific populations because for the most part they arrived in a time period when obesity was (and still is) increasing in prevalence in Israel [17] relative to earlier periods. Presumably, this would produce the greatest environmental pressure on newly arriving immigrants in the context of "healthy immigrant effect."

Methods

Data collection

In Israel, all Jewish Israeli citizens are obligated by law to serve as conscripts at the age of 18 years in the Israeli Defense Forces (IDF). The draft process includes preliminary medical examinations at the age of approximately 17 years, in which the candidates are measured for weight and height and also provide sociodemographic data such as country of birth, year of birth, and year of immigration (when applicable).

The study population includes male adolescents grossly divided into three groups: (1) immigrants who were born abroad and consequently immigrated to Israel; (2) Israel-born immigrants, that is, those who were born in Israel to immigrating ancestry; and (3) native Israelis who have ancestry in Israel for at least two previous generations. Of the complete database comprised from all military service candidates (most Jewish 17-year-old in the country), we included in the immigrant groups only those who were born in the USSR and Ethiopia in this study and those who have ancestry in those countries (paternal or grandpaternal). Only male participants were included in the study as many Jewish Orthodox girls are exempt from military service, producing relatively incomplete data registries.

The study population included participants who were born between 1970 and 1993, which is the final examination year in the database at the time of the analysis. All participants who were born before 1970 were excluded, both in the foreign-born and Israel-born subgroups. This was done to compare them in a grossly similar time frame when most immigrants arrived in Israel. In addition, the statistical analysis was adjusted for birth year to minimize the confounding effect of examination time within the study sample.

The study was approved by a Helsinki Declaration committee using historical data stored in registries of the IDF.

Weight categorization

All participants were categorized by definitions proposed by Cole et al. [18], formally adopted by the International Obesity Task Force (IOTF). These include three categories: normal weight, overweight, and obese (according to IOTF definitions, the cutoff BMI levels for obesity and overweight for 17-year-old males are 29.41 and 24.46 kg/m^2, respectively). A fourth category proposed by Cole et al. [19] of underweight has yet to be formally adopted by IOTF but was also included in the present study. The IOTF's definitions are based on BMI, adjusted by gender and age to reflect weight norms and converge with adult definitions at the age of 18 years (30 and 25 kg/m^2 for obesity and overweight, respectively). They are based on an international pool of children and adolescents [18,19] and were previously used by Meydan et al. [17] in a descriptive weight study in the Israeli population. For participants who were examined when they were older than 18 years of age, adult weight definitions were used.

BMI was calculated by dividing weight (kilogram) by square height (square meter). Subjects were measured barefoot, wearing only undergarments. The measurements were conducted by trained personnel of the IDF on the day of examination.

Geographical birthplace and origin

The parameter of country of birth was gathered for foreign-born immigrants, alongside year of immigration.

For Israeli-born participants, country of origin replaces country of birth and was determined by the paternal birth country. In cases where paternal or grandpaternal birth country was the USSR or Ethiopia, the participants were designated Israel-born immigrants. In cases where the both paternal and grandpaternal birth countries were Israel, the participants were designated native Israelis.

Socio-economic factors

Alongside information about physical measurements, birthplace, and origins, data relevant to socio-economic status in Israel were collected; including level of education, indicated by completion of grades in the school system ($\leq$10th grade or $>$11th grade), reflecting the social and financial ability to stay in school rather than drop out. In addition, a socio-economic score (SES) was given according to municipality of residence, as a measure of the general socio-economic context in which the participant was raised. The scoring system was based on the scale developed by the Israeli Central Bureau of Statistics [20], which stratifies all municipalities into 10 ranks according to various parameters, including income levels, unemployment rates, age distribution, and education levels [20]. This 10-tiered stratification was then grouped into three categories: low (1–4), medium (5–7), and high (8–10). The third socio-economic parameter was the influence of rural versus urban residence, representing a gross lifestyle difference. The parameters were integrated into the statistical analysis together with age at immigration, the rationale being to minimize the effect of social inequality over the results, as this in itself imposes risk for high weight. This has been demonstrated in previous research including that of our own group, which used the same classification as presented here [17,21,22].