

# Osteoporosis among Ethiopian immigrant women: a risk analysis

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## Abstract

**Summary** The objective was to evaluate the prevalence of osteoporosis among Ethiopian immigrant and Israeli-born women and to determine the risk factors. The study revealed extreme prevalence of osteoporosis among Ethiopian immigrants (38.7%). A strong association between calcium intake during adolescence, BMI, lactation duration, physical activity, oral contraceptive and osteoporosis is suggested.

**Introduction** Osteoporosis is a chronic disease characterized by low bone mass and deterioration in the micro-architecture of bone that increases its susceptibility to fractures. We set out to evaluate the prevalence of osteoporosis among

Ethiopian immigrant and Israeli-born women and to determine the risk factors.

**Methods** A cross-sectional study among 181 Ethiopians immigrants and 98 Israeli-born women. Hip, forearm and spinal bone mineral density (BMD) were measured. Risk factor information was obtained from an interview. BMD and osteoporosis rates were compared between the groups. Stepwise regression models were constructed for osteoporosis as the dependent variable controlling for potential confounders.

**Results** We defined 38.7% Ethiopian and 5.2% Israeli-born women as having osteoporosis. Rates of low BMI, prolonged lactation, age at first giving birth and sunlight exposure were higher in Ethiopian women compared to the Israeli-born. Multivariate analysis revealed a strong association between calcium intake during adolescence, BMI, lactation duration, physical activity, oral contraceptive use and osteoporosis.

**Conclusions** The prevalence of osteoporosis among Ethiopian immigrant women living in Israel is extremely high compared to national and international rates. Therefore, we suggest that an immediate prevention program among Ethiopian women be started and guidelines for care-givers be developed, in order to raise their awareness for osteoporosis.

**Keywords** Bone density · Calcium intake · Ethiopian immigrants · Osteoporosis · Osteoporosis risk analysis

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## Introduction

Osteoporosis is a chronic, systemic, multifactorial disease characterized by low bone mineral density (BMD) and deterioration in the bone micro-architecture that increases its susceptibility to fracture [1, 2]. Osteoporosis is associ-

ated with fractures of the hip, spine and other skeletal sites [3], resulting in significant morbidity, mortality and health care costs [4–6]. The estimated cost of osteoporotic fractures to the US health care system is approximately \$17 billion annually, with an annual cost projected to approach \$50 billion by the year 2040 [7].

Osteoporosis affects at least 25% of all postmenopausal white women in the United States, and the proportion rises to 70% in women over 80 years of age [8]. In its prevalence report from 2004, the American National Osteoporosis Foundation indicated that, among those younger than 50 years of age, 20% of white women and five% of African-American (AA) has Osteoporosis [9]. Also, it has been known for at least 40 years that fracture risk is lower among AA women compared to white men and women in the United States [10]. African immigrants who immigrated to the United States tend to suffer more from osteoporosis than AA who were born in the USA [11].

In Israel, the prevalence of osteoporosis among Israeli women older than 21 years of age is almost 9% [12].

Many risk factors are associated with osteoporosis and osteoporotic fracture, including low peak bone mass, hormonal factors, the use of certain drugs (e.g., glucocorticoids), cigarette smoking, low physical activity, low intake of calcium and vitamin D during adolescence, race, small body size, multiple prolonged lactations and a personal or family history of fractures [5, 13–17].

During the last decade, Israel has experienced a large immigration wave from Ethiopia. In their homeland, people suffered from malnutrition during their childhood, and dairy consumption was very low due to the lack of preservation technologies. The traditional clothes cover most of their body surface, together with their dark skin, impedes the production of vitamin D in the skin. In Israel, Ethiopian immigrants are considered as a low socio-economic class and can be identified as a “population in transition”.

As a population with many risk factors for osteoporosis, we hypothesized that the Ethiopian adult woman living in Israel might suffer from lower BMD and higher osteoporosis rates compared to the Israeli-born woman.

The main objective of this study was to assess differences in osteoporosis prevalence between Ethiopian and Israeli-born women living in the southern region of the country, and to compare the prevalence of specific risk factors for osteoporosis between these women.

## Methods

### Participants

Two hundred and seventy-nine Israeli adult women participated in this cross-sectional study: 181 Ethiopian

immigrant women and 98 Israeli-born women living in the same region. All subjects were older than 25 years of age (lower age limit) and were recruited and examined throughout 2005.

Immigrants from Ethiopia form a unique community in Israel. Immigrating as the result of persecution and hunger, they were brought to Israel in a continuous wave of immigration originating in the early 1990s. The overwhelming majority of these immigrants arrived from rural communities in Ethiopia and had no education or transition period in this process. In most cities of Israel, the immigrants form urban communities in certain neighborhoods where they choose to live. Our study was conducted in a few neighborhoods in the country’s southern region.

Given all of the above, the immigrant population is vastly different from the “veteran” Israelis; specifically, the immigrants income is much lower than the average income, fertility is greater among the immigrants, and it carries on to a relatively old age. The immigrants’ command of the Hebrew language is incomplete, and illiteracy is the rule among women born in Ethiopia. Due to these difficulties, most organizations that work with the immigrants hire mediators to facilitate communication. The mediators come from the immigrant population, they are fluent in both Hebrew and Amharic language, and most are known to the community. The presence allows, beyond translation and mediation, the formation of trust between the establishment and the Ethiopian community. These mediators recruited the study population through “door-to-door” visits.

### Recruitment

A study representative have visited all the community and observation centers located in the region’s Ethiopian neighborhoods. In these meetings the study objectives were introduced to the local community workers who performed a list with the eligible subjects. The mediator found the listed subjects and brought them by organized transportation to the hospital clinic where the BMD tests were performed. In addition, the mediator encouraged the eligible subjects by door-to-door visits in the same neighborhoods and brought them by organized transportation to the tests. One should know, that in all the southern region of Israel the Ethiopian population is living in certain neighborhoods and in total they comprise 1.4% of the entire population.

At the beginning, due to great amount of suspicion, it was very difficult to recruit the subjects. It required intensive work by the mediator to finally convince them to participate.

The comparison group was recruited from six kibbutz communities of the same geographic area. From the kibbutz, we recruited only Israeli born or women who joined the kibbutz before adolescence. Although the kibbutz has been challenged over the last decade, it could

certainly be said that kibbutz members have free and good access to high quality food, and that their nutrition is particularly rich in dairy products. We did not want to mix our comparison group with South Africans, holocaust survivors, Asians and other frequent newcomers to the Israeli society.

This group was recruited by local public health nurses who called the members to participate.

## Materials

Information about dairy product consumption during adolescence, demographic details (age, marital status), osteoporosis risk factors (exposure to sun light, physical activity, lactation, parity, medical history) and information regarding the participant's life style (smoking habits, HRT use, oral contraceptive use, food supplements) was obtained using a structured questionnaire. For the Israeli-born women it was a self-administered questionnaire, while the Ethiopians immigrants were interviewed by a professional interpreter.

Dairy calcium consumption was estimated from a questionnaire with questions concerning the frequency of use of dairy products during adolescence: milk, yogurt, cream cheese and yellow cheese.

In addition, all study subjects were tested for bone densitometry by dual-energy X-ray absorptiometry (DXA) of hip, forearm and lumbar spine. This technique is routinely used for testing the Israeli population. The tests were performed in the local hospitals' BMD units by trained technicians. The results were then reviewed and approved by the chief endocrinologist. The tests were free of charge.

The DXA equipment is approved for use in Israel with its "built in" references.

## Definition of low bone mineral density (BMD)

BMD measurements were expressed in grams per centimeter squared and as the T score, using World Health Organization (WHO) definitions. According to these criteria, BMD measurements between 1 and 2.5 SD below the average for the young normal reference population were classified as consistent with osteopenia (T score between  $-1$  and  $-2.5$ ). Measurements that were  $<-2.5$  SD below the young adult mean were classified as osteoporosis [3].

## Data analysis

Descriptive statistics techniques were used to describe the study population. In order to assess differences in risk factors between the study groups (A: Ethiopian vs. Israeli-born, B: having vs. not having osteoporosis), we used t-test and chi square techniques according to the nature of the

variables. A non-parametric Mann–Whitney test was carried out on variables that were not normally distributed. Stepwise logistic regression model was used to determine the independent contribution of the risk factors for osteoporosis after controlling for possible confounders to the risk of osteoporosis. Goodness of fit measures were used to select the best fitting model.

## Ethics

This study was approved and supervised by the local ethics committee.

## Results

### Study population

Two hundred and seventy-nine women were recruited to our study: 181 Ethiopian immigrants to Israel living in the southern region of the country and 98 Israeli-born women living in the same region.

### Demographic details

The mean age was significantly different between the groups. The mean age among women in the Ethiopian group was 45.1 years ( $\pm 13.9$ ), whereas the mean among women in the Israeli-born group was 52.1 years ( $\pm 8.8$ ). The percentage of women who were older than 50 years among the Ethiopian group was 48.1% compared to 66.3% among the Israeli-born group. Most of the women in both groups were married, but the percentage among the women in the Israeli-born group was significantly higher (81.6%) than among the Ethiopian group (64.2%) (Table 1).

### Anthropometric details

Low BMI is known as a risk factor for osteoporosis. The mean BMI of the Ethiopian women group was significantly lower than that of the Israeli-born group 23.0 ( $\pm 4.2$ ) and 25.7 ( $\pm 4.6$ ), respectively (Table 1).

### Lifestyle

More than 90% of the Ethiopian women reported that they had performed physical activity during their adolescence compared with 53.9% of the women in the Israeli-born group. More than 41% of the Ethiopian women reported a high degree of sunlight exposure during adolescence in contrast with 5.1% of the Israeli-born women. Nonetheless, we assume that when the exposure took place the Ethiopian women wore traditional clothing so that most of their body

**Table 1** Demographic, health and life style indicators

Indicator	Ethiopian	Israeli-Born	P value
Mean age	45.1 (13.9)	52.1 (8.8)	0.029
% Married	64.2	81.6	<0.001
Mean BMI*	23.9 (4.2)	25.7 (4.6)	0.001
Highly physical activity during adolescence (%)	90.5	37.5	<0.001
% Past oral contraceptive use	29.3	69.4	<0.001
% Use of food supplements	10.0	18.4	<0.001
% Past use of HRT**	–	37.6	–
% Past smoking	1.2	32.3	<0.001
% Current smoking	1.2	13.3	<0.001
Mean age at menarche	14.5 (2.3)	13.0 (1.6)	<0.001
Mean age at first giving birth	18.2 (4.3)	24 (4.7)	<0.001
Mean cumulative lactation duration	14 Years	7 Months	<0.001

(Standard deviation)

\* Body mass index, \*\* Hormone replacement therapy

was covered, and, therefore, in fact they were exposed to a lower degree to sunlight. Of the Ethiopian women, 29.3% used oral contraceptive pills compared with 69.4% of the Israeli-born women (Table 1).

The Ethiopian women had not used hormone replacement therapy (HRT) in the past or during the time they completed the study questionnaire, whereas 37.6% and 21.3% of the Israeli-born women reported the use of HRT in the past or during the time they completed the study questionnaire, respectively.

Of the Ethiopian women, 1.2% reported being present smokers; the same percentage reported being past smokers. In the Israeli-born group, 13.3% reported being present smokers and 32.3% reported being past smokers. We did not find significant differences between the two groups in the mean use of cigarettes per day (Table 1).

#### Gynecologic history

The mean marriage age among the Ethiopian women was 14 ( $\pm 4.9$ ) years compared with 22.7 ( $\pm 3.2$ ) years among the Israeli-born group. The mean age of the first delivery was 18.2 ( $\pm 4.3$ ) years among the Ethiopian women compared with 24 ( $\pm 4.7$ ) years among the Israeli-born women. The difference between the two groups in both parameters was statistically significant.

Long lactation periods in malnourished women and multiparity are also known as risk factors responsible for osteoporosis. Ninety-six percent of the Ethiopian women had nursed their children as opposed to 90% of the Israeli-born women. Lactation duration was statistically different between the groups: the Ethiopian women's group reported 14 ( $\pm 7.9$ ) years and the Israeli-born women's group

reported 7 ( $\pm 2.3$ ) months. Some of the Ethiopian women had nursed more than one child simultaneously.

We found a significant difference in the mean number of pregnancies: the Ethiopian women reported 6.8 ( $\pm 2.8$ ) pregnancies as opposed to 3.9 ( $\pm 1.6$ ) among Israeli-born women (Table 1).

#### Medical history

Of all the study subjects, 38.4% reported having had at least one chronic illness (diabetes mellitus, osteoporosis, asthma, heart disease hypertension, parathyroid functional disorders, cancer, etc.). The difference in this parameter was statistically significant between the groups (48% among Israeli-born women and 33% among the Ethiopian women). Fifteen percent of the Israeli-born women reported having had an illness that can induce osteoporosis (parathyroid functional disorders, cancer, etc.) compared with only 1.7% of the Ethiopian women (Table 1).

#### Nutritional history

Statistically significant differences were found regarding dairy product eating habits during adolescence. The Ethiopian women consumed less dairy products during their adolescent period than the Israeli-born women. Calcium consumption among the Israeli-born women was significantly higher than among the Ethiopian women (342.7 mg/d and 111.16 mg/d respectively), although neither of the groups reach the recommended dietary allowances (RDA)\_ recommendation (Table 2).

#### Bone mineral density

All the study subjects were tested for bone density by dual-energy X-ray absorptiometry (DXA) of hip, forearm and lumbar spine. According to the BMD test, there is a statistically significant difference in osteoporosis prevalence between our two study groups. The Ethiopian women demonstrate extremely high rates of osteoporosis compared to Israeli and western world rates. Among Ethiopian women, the prevalence of osteoporosis was 38.7% compared with 5.2% among the Israeli-born women. The fact

**Table 2** Dairy products consumption during adolescence period

P value	Israeli-born (%)	Ethiopian (%)	Weekly portion
0–3	60.2	18.4	<0.001
4–11	36.5	53.1	<0.001
12+	3.3	28.6	<0.001
Past calcium consumption (mg/d)	111.16	342.7	<0.001

that we compared two groups with different mean ages is an advantage in this case because it strengthens the fact that the prevalence of osteoporosis was higher among the younger group (the Ethiopian women). The osteoporosis rates of the Israeli-born women are slightly below the published national figures (8.9%) [12], but the prevalence rates among the Ethiopians are extremely high compared to the national rates (Table 3).

We also compared the non-dependent variables between the women who have osteoporosis and the women who did not have osteoporosis as a preparation for the multivariate analysis. We found significant differences between the two groups in all the variables, excluding age, and the existence of illnesses that can induce osteoporosis (Table 4).

### Multivariate analysis

The purpose of the multivariate analysis was to reveal the individual influence of each independent variable on the risk of developing osteoporosis.

The multivariate analysis revealed a strong association between calcium consumption in adolescence and osteoporosis after adjusting for the other independent variables.

The result showed that history of high calcium consumption, old age and history of oral contraceptive use reduce the risk of developing osteoporosis, and that low BMI, prolonged lactation period and intensive physical activity during adolescence increase the risk of developing osteoporosis among the Ethiopian women (Table 5).

### Discussion

Our study results revealed an extreme prevalence of osteoporosis among Ethiopian women who have immigrated to Israel during the last decade. According to the study result, 38.7% of the Ethiopian women who participated in this study have osteoporosis. As part of the European

**Table 3** Bone mineral density measurements (SD)

	P value	Israeli-born	Ethiopian
% of normal BMD at 25 years of age			
Forearm	90.3 (8.8)	99.2 (8.7)	<0.001
Femoral neck	98.9 (16.4)	101.0 (14.0)	0.289
Lumbar spine	86.3 (13.4)	104.14 (15.7)	<0.001
Mean Z score			
Forearm	-1.0 (0.9)	-0.08 (0.9)	<0.001
Femoral neck	0.0 (1.0)	0.007 (0.9)	0.530
Lumbar spine	-1.26 (1.5)	0.33 (1.3)	<0.001
% osteoporosis	38.7	5.2	<0.001

**Table 4** Distribution of independent variables included in the regression modeling between the two dependent groups

	Having osteoporosis	Not having osteoporosis	P value
Age*	178.79	112.63	<0.001
Age at menarche*	117.04	134.61	0.094
Age at first giving birth*	95.80	119.06	0.022
Past calcium consumption*	102.05	139.95	<0.001
BMI*	95.39	131.34	<0.001
Cumulative lactation* duration	167.58	116.62	<0.001
Smoking (%)	4.5	16.7	0.008
Having co-morbidity (%)	1.5	3.7	0.333
Use of oral contraceptives (%)	13.2	57.6	<0.001
Past physical activity (%)	92.6	61.8	<0.001
Past use of HRT (%)	2.9	20.9	<0.001

\*Non-parametric Mann–Whitney test  
Mean ranks\* and percentages

Health Interview Surveys (EUROHIS), the Israeli Ministry of Health initiated a health survey in 2004 where it was found that 8.9% of Israeli women older than 21 years have osteoporosis, meaning that there is a great gap in osteoporosis prevalence between Israeli and Ethiopian women. The prevalence of osteoporosis among Ethiopian women is higher than that among the women of African descent older than 50 years in the USA (5%) [9].

Our study reveals another interesting detail; the prevalence of osteoporosis among Israeli-born women is lower compared to other national rates. This can be explained by the fact that the Israeli society is very heterogeneous from an ethnic point of view, and the majority of residents are not Israeli-born.

The main risk factors that we have recognized in this study were low intake of calcium during adolescence, low BMI, prolonged lactation period and age. Oral contraceptive treatment was found to have a protective influence on bone density. Those findings are compatible with scientific literature [5, 13–17].

Low intake of calcium is a well-known risk factor for developing osteoporosis. Adequate calcium intake during

**Table 5** Results of the final regression model

Variable	B	SE	P
BMI	-0.304	0.074	<0.001
Cumulative lactation duration	0.051	0.025	0.043
Age	0.127	0.027	<0.001
Past physical activity	1.951	0.814	0.017
Oral contraceptives	-1.705	0.534	0.001
Past calcium consumption	-0.003	0.002	0.041
Constant	-1.708	1.870	0.361

childhood and adolescence is important since the peak calcium-accretion rate is achieved at the age of 12.5 years among girls and 14 years among boys. During the 3–4 years of bone growth in an adolescent, there is accumulation of 40% of the future bone mass. Many reports suggest that intake of calcium supplementation during the adolescent period improves bone health and bone mineralization and is effective in the prevention of osteoporosis in the future, though in order to obtain those results, intake should continue for long periods. Therefore, a high calcium diet should be established during adolescence [18–21].

Recent research shows that low BMD is a risk factor for fractures among children, and that children who avoid drinking cow's milk have poor bone health and a higher risk for developing fractures [18, 21–23].

Milk products are a main source of calcium. The calcium content in low fat milk products is the same as that in full fat products. About 99% of the calcium in the body is located in the skeleton and only a small amount is in the extra cellular fluid. Calcium homeostasis is achieved by calcium regulating hormones, the most important of which is vitamin D. Calcium active absorption, which is more significant in situations with a lack of calcium, is regulated by vitamin D, although this compensation mechanism is limited. Therefore, an adequate calcium intake in the diet is of great importance. It is well known that lack of calcium causes a decrease in BMD and osteoporosis. Many studies have shown that treatment with a combination of vitamin D and calcium to patients who suffer from osteoporosis moderates the bone destruction rate [21, 24–27].

Milk basic protein (MBP) is another component in milk that participates in the absorption of calcium by the bone. A recent study has shown that when it was given to women, their calcium absorption was increased and their BMD improved compared to women who were not given MPD [28].

Many researchers have found old age, low weight and long-term lactation periods to be risk factors for development of osteoporosis and bone fractures [5, 14–16, 29–31].

Estrogen, oral contraceptives and hormone replacement therapy have a good influence on bone health [32–37].

The high morbidity among the Ethiopian group can be explained in several ways: the Ethiopian community immigrated to a western country, Israel, from a developing country where most of them had suffered from starvation and malnutrition and have low BMIs. Lauderdale et al. [38] investigated the possibility that Chinese women who immigrated to the United States are at a higher risk of developing osteoporosis. They assumed that many of the women would have had poor nutrition in childhood, have thin body habitus, and have difficulties in accessing

medical care because of finances, lack of insurance, language and distrust of the medical system. According to their research results, women born in southern China and now residing in Chicago's Chinatown have low average calcaneal BMD and their average BMD is lower than reference values for white women and U.S.-born Asian-American women. Those results strongly suggest that risk of osteoporosis varies by birthplace and age at immigration for Asian women in the United States and may vary by ethnicity because a high proportion of the reference series of U.S.-born Asian women were Japanese. Foreign-born Asian-American women, particularly those who immigrated recently, appear to be a high-risk group for osteoporosis. This immigrant population has many characteristics parallel with the Ethiopian community living in Israel.

The Ethiopian population in Israel is characterized by keeping traditional Jewish laws: adult women wear a head covering and traditional clothing that covers most of their body. The Ethiopian women who participated in this study reported that they were highly exposed to sunlight; nonetheless at the time of the exposure to sunlight their clothing covered most of their body surface and therefore in reality, they had little exposure to sunlight. Those facts decrease the production of vitamin D by the skin. Many researchers have shown that vitamin D level is lower among black Americans than among white Americans because of pigmentation differences. [9, 39, 40] One can assume that a low vitamin D level exists in the Ethiopian population as well, a condition that can contribute to low bone absorption. Other factors that can accelerate the decrease in bone mass among the Ethiopian women are multiparity, labor at a young age, long breastfeeding periods, lack of awareness of hormone replacement therapy, low socioeconomic status, low educational level, and being a community in transition [14, 41].

The Ethiopian women reported that during their childhood and adolescence they did not eat dairy products because of lack of cooling techniques and problems in preserving milk (if they had a cow, they would milk it and drink the milk immediately after). Moreover, many in this population suffer from lactose intolerance, a problem that is common among the African population. [18, 42] The main source of calcium is milk and its products. Calcium nutrition during adolescence among the Ethiopian population did not achieve the DRI recommendation that is approximately 1300 mg per day at 9–18 years of age. Lack of calcium in the nutrition during adolescence is an important risk factor for development of osteoporosis and bone fractures.

The Ethiopian population had carried out physical activity during their daily activities: during the cultivation of field crops and in particular during the long travel to

Addis Ababa. The protective influence of physical activity on the bone was not expressed in this case, probably because the influence of the risk factor was stronger and blocked the physical activity influence. Moreover, it is possible that there is a genetic tendency among the Ethiopian population to develop osteoporosis. Further investigation is needed to identify this tendency.

Our study suffers from several limitations. First, the study subjects were not recruited using scientific sampling methods. It is almost impossible in this unique population group to perform such methods. However, we still consider our study group as a sample which can give us good information about osteoporosis and risk factor prevalence.

Calcium intake was assessed using few questions regarding milk- and milk products intake in the past, rather than through a comprehensive assessment. Past nutritional interviews are vulnerable to recall bias. In addition, the index we used to find “past calcium intake” was only an estimation of calcium intake. However, we need to take into account that a more comprehensive strategy for dietary assessment among new immigrants from Ethiopia is lacking, and due to the culture and educational differences we could not use existing dietary assessment tools. Second, the Israeli-born women in our study were recruited from a kibbutz, which is a small cooperative community, relatively homogeneous with good access to healthy nutrition and lifestyle during childhood and adolescence. Therefore, they may not represent entirely the Israeli women population, which is more diverse, and, indeed, we found lower osteoporosis rate in this group compared to the national rates. On the other hand, the Ethiopian women who participated in our study certainly can represent this population in Israel. We can assume that the Ethiopian women living in the south of Israel resemble Ethiopian women living in other parts of Israel. Nonetheless, our study was not designed as a “case-control” study, and the kibbutz group should not be considered a control group; this fact influenced the multivariate analysis, and possibly also the results.

Language difficulties and accessibility problems deepen the suspicion that the Ethiopian women felt toward the study and the unknown bone densitometry tests. We overcame this obstacle using a professional interpreter who understood Amharic and served as a mediator.

Another limitation to our study is the lack of information about osteoporosis in Ethiopian women living in Ethiopia. This information was not available despite a thorough literature search. There is also lack of information regarding influence of age on osteoporosis in this population. Our reference point for diagnosis is appropriate for western population and possibly not appropriate for the Ethiopian population.

## Conclusions

Policy and preventive program—considering the study results, the Israeli health authorities should design an immediate preventive program for Ethiopian immigrant women. The aim of these programs would include raising awareness to the importance of healthy nutrition and physical activity during childhood and adolescence. Secondary prevention should take place, including awareness raising (among the patients and caregivers) to new diagnostic tests, detailed high risk patient follow-ups and medical therapy after diagnosis to prevent acceleration of the disease. In addition sub-analysis of the Israeli group for identifying Israeli women at high risk who should have additional targeted strategies is recommended.

Osteoporosis and consequent fractures are associated with physical, social and mental burdens, and have a similar impact on the quality of life as a physical disability [8, 43]. Therefore, preventive programs among the elderly population should be carried out. Moreover, action should be taken to prevent a recurrence of fractures among those patients and to obtain maximal rehabilitation as tertiary prevention.

The prevention of osteoporosis is very important in order to reduce the burden of this disease on society and to reduce consequent fractures and their complications [8].

A free BMD test to this high risk population and instructions regarding the high suspicion among caregivers should be considered since many researchers showed that having a history of osteoporotic fractures is an important risk factor for recurrence of fractures [8, 44, 45]. Further research should take place to investigate the morbidity and risk factor tendency among Israeli women, in general, and among Israeli-Ethiopian women, in particular.

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