

# DIFFERENCES IN FOOD INTAKE AND DISPARITY IN OBESITY RATES BETWEEN ADULT JEWS AND BEDOUINS IN SOUTHERN ISRAEL

**Objective:** The goal of this study was to compare eating patterns of Jews and Muslim Bedouins and investigate possible dietary causes for discrepancy in obesity rates.

**Methods:** We pooled two surveys that included data from 793 Jews and 169 Bedouins aged 35–64 years recruited from 1998 through 2003 in southern Israel. For the Jewish sample, we used a proportional geographic cluster random sample of persons aged  $\geq 35$  years. For the Bedouins, a convenience sample of 519 participants was used. Participants were interviewed at home, using modified 24-hour food questionnaires with additional questions regarding health and eating habits.

**Results:** The Jewish group was older and better educated than were the Bedouins. The Bedouins had a higher age-adjusted body mass index than did the Jews ( $P=.03$ ), and the rate of obesity was higher among Bedouins than Jews (27.9% vs 20.0%, respectively). Compared to Jewish men, Bedouin men reported lower intake of fat, cholesterol, total saturated fat, and protein and fat as a percentage of total energy, but they reported higher intake of carbohydrates, fiber, and carbohydrates as a percentage of total energy. Bedouin women reported lower intake of total saturated fat, percentage of protein and fat, and higher intake of carbohydrates and fiber than did Jewish women.

**Conclusion:** The Bedouin population is adapting Western eating patterns that appear to be associated with increased obesity. To address this problem, culturally sensitive intervention programs will have to be developed. (*Ethn Dis*. 2008;18:13–18)

**Key Words:** Obesity, Bedouins, Jews, Dietary Intake, Lifestyle

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## INTRODUCTION

The shift from acute infectious diseases to chronic, noncommunicable health conditions is a complex and dynamic epidemiologic process.<sup>1</sup> Nutritional transition is one of the components of such processes and is associated with changes in lifestyle factors such as physical activity, use of alcohol and tobacco, increased stress, and changes in dietary patterns. These factors, in turn, are related to the rapid increase in prevalence of overweight and obesity, resulting in chronic and degenerative diseases.<sup>2,3</sup>

The Negev region in southern Israel is the home of two subpopulations, Jews and Bedouins, each with its own culture and socioeconomic and educational systems. The Jewish population in Negev is mostly urban and of lower socioeconomic status than Jews in Israel as a whole; a high percentage of the Jewish population are new immigrants from the former Soviet Union.

The Bedouins are a Muslim population in transition from a nomadic to a settled lifestyle and are at the lowest socioeconomic level of all population groups in Israel. These residents, who account for  $\approx 25\%$  of the Negev population,<sup>4,5</sup> are on average younger than Jewish residents in the region and in the country as a whole. The Negev Jewish population has a higher educational level than does the Bedouin population, and Bedouins also have higher rates of unemployment and lower monthly incomes than do the Jewish population.<sup>4,5</sup>

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Vital statistics on the Negev population have not been published; however, national data show that while death rates from acute myocardial infarction and cardiovascular disease decreased during the past four decades in both Jewish and Arab populations, the age-adjusted rates are higher in Muslims, which cannot be attributed to differences in healthcare access.<sup>6</sup> Age-adjusted prevalence of diabetes is substantially higher in Arab populations, and the difference is even more prominent in women.<sup>7</sup> Arab ethnicity was shown to be an independent risk factor for obesity in women in a national survey.<sup>8</sup>

Nutrition is recognized as a key lifestyle factor in the development of obesity and chronic diseases.<sup>9–12</sup> Since the last comparison between diets of Jews and Arabs was published in 1964,<sup>13</sup> this study was undertaken in view of the lack of current dietary information on Jews and Muslims. The main goal of this study was to compare the eating patterns of two populations that live side by side—Jews and Muslim Bedouins—to investigate possible causes for the discrepancy in obesity rates, with the intention of

developing culture-sensitive preventive programs for these populations.

## METHODS

The study, which was conducted from 1998 to 2003, was intended to assess dietary intake and eating patterns of the Negev population. A proportional geographic cluster random sample of the Negev population in Israel was obtained of persons aged  $\geq 35$  years. From each geographic cluster (largely Jewish settlement in southern Israel), we randomly selected 15–20 households, and in each household one adult member was randomly chosen and interviewed in person at home by a trained interviewer. The 1173 persons interviewed represent 89.5% of the original sample. Most noncompliance was due to death or language difficulties. Dietary intake data were collected by using a multi-pass 24-hour recall questionnaire modified and tested in Israel,<sup>14</sup> based on the United States Department of Agriculture (USDA) 24-hour food questionnaire (USDA, Continuing Survey of Food Intakes by Individuals, CSFII 1994, CSFII 1995). For the Bedouins, a convenience sample of 519 adult participants was used, as census data are inadequate to obtain a random population sample. Care was taken, however, to obtain dietary interviews from both urban households and rural households in unrecognized settlements.

A further-modified version of the 24-hour recall was constructed to obtain quantitative information on foods consumed from common plates, taking into account the traditional eating habits and eating etiquette of the population. One of those traditions is to use bread or pita as the utensil and consume it with the food scooped up in it. Although the methods have been presented elsewhere in detail,<sup>15</sup> we will describe them briefly here. For each item in the fast list, we inquired if it had been con-

**Table 1. Selected background characteristics of the study sample (n=962)**

Characteristic	Jews n=793	Bedouins n=169	P
Age, years	50.1±7.9	43.1±7.1	<.001
Male	345 (43.7)	56 (33.3)	.008
Body mass index (BMI)*†	26.6±4.6	27.9±5.3	.03†
Obesity (BMI>30)†	159 (20)	47 (28)	<.026†
Education, years	12.4±4.1	6.6±4.7	<.001
Currently on any diet	199 (25.2)	15 (8.9)	<.001
Reported amount of food eaten yesterday was as usual	581 (73.4)	140 (82.8)	.005

Values are given as mean ± standard deviation or n (%).

\* Age-adjusted.

† Pregnant women were excluded from the weight and BMI analyses (28 Bedouin women and 6 Jewish women).

sumed with or without bread. Items consumed with bread in a single sitting (multi-dish meals) were enclosed in brackets. The total quantity of bread or pita used during that meal was then reported. Two additional items of information were requested per item consumed in a multi-dish meal. First we enquired about the consistency of the food; whether it was watery, slightly dense, or dense. Then we determined the relative quantities of the individual dishes consumed; these were reported as small, medium, or large, and quantified by using 1 for small, 2 for medium, and 3 for large in the questionnaire. The total quantity of bread was then divided by total quantity of sizes. The quantity of food eaten from each dish was calculated on the basis of mean weights of foods of different consistencies scooped up with bread in test kitchen weightings (grams of food per gram of bread) and multiplied by the quantity of bread eaten with each dish.

For meals eaten from a single large common platter without bread, pictures with different relative portions removed from the plate were used as reporting aids. Individual items consumed Western-style were reported in the usual way.

Background data were compared by using an independent sample *t* test and  $\chi^2$  tests. Age-adjusted comparisons were performed (in five-year age groups) by using general linear models (SPSS, version 12). Differences were defined as statistically significant at  $P < .05$ .

## RESULTS

This analysis includes all Jews and Bedouins from the surveys described above aged 35–64 years (793 Jews and 169 Bedouins) of both sexes but excluded reports from Bedouins collected during the Ramadan season. Urban Bedouins represent  $\approx 64.2\%$  of the Bedouin sample (74% of the women and 44% of the men). The Jewish group was on average older, with a lower representation of women, and had nearly double the years of education compared with the Bedouins (Table 1).

More Bedouin women were pregnant or breastfeeding at the time of interview than Jewish women (24.8% vs 1.3%, respectively); they were excluded from the body mass index (BMI) and obesity analyses. The Bedouins had higher age-adjusted BMIs than the Jews ( $P = .03$ ), and more of them reported being on a diet. The rate of obesity was higher among Bedouins than among Jews (27.8% vs 20.1%) and more so among Bedouin women than among Jewish women (36.3% vs. 23.2%,  $P < .001$ ). Almost all Bedouin participants (154, 91.1%) defined themselves as having excellent or good health compared to 605 (76.3%) of the Jews ( $P < .01$ ). Nearly all Bedouins were married, compared with only 83% of the Jews ( $P < .05$ ).

Because of differences in age composition and the effects of age on dietary intake, we used age-adjusted data to

**Table 2. Age-adjusted means of daily energy (Kcal/day) and selected nutrient intake (g/day) in the Study Sample**

Nutrient	Men			Women		
	Jews n=348	Bedouins n=56	P	Jews n=445	Bedouins n=113	P
Energy	2133 (47)	2079 (124)	.68	1520 (34)	1770 (68)	.58
Protein	82.5 (2.2)	74.5 (5.8)	.21	59.9 (1.4)	61.9 (2.8)	.55
Carbohydrates	278.5 (6.9)	322.8 (18.2)	.03	197.8 (4.6)	272.1 (9.5)	<.01
Fiber	21.3 (.7)	35.8 (1.9)	<.01	16.4 (.5)	25.8 (1.0)	<.01
Total fat	76.8 (2.2)	61.4 (5.8)	.02	57.3 (1.7)	53.3 (3.5)	.32
Cholesterol	298.6 (14.8)	214.5 (39.2)	.05	214.1 (1.5)	174.1 (21.5)	.10
Saturated fat	23.0 (.7)	14.7 (1.9)	<.01	17.4 (.5)	13.9 (1.1)	<.01
Monounsaturated fat	27.2 (.9)	26.3 (2.3)	.70	20.3 (.7)	21.6 (1.4)	.43
Polyunsaturated fat	20.8 (.8)	17.1 (2.8)	.14	14.8 (.6)	14.1 (1.2)	.58
Macronutrient energy as percentage of total energy intake						
Protein	15.7 (.3)	14.2 (.7)	.04	16.3 (.2)	14.1 (.5)	<.01
Fat	31.8 (.5)	26.4 (1.4)	<.01	32.8 (.5)	25.9 (1.0)	<.01
Carbohydrates	52.9 (.6)	62.2 (1.6)	<.01	52.7 (.5)	62.5 (1.1)	<.01

Values are given as mean (standard error).

compare the sex-specific food intake between Jews and Bedouins (Table 2). No difference in energy intake was found in either sex. Compared to Jews, Bedouin men reported lower intake of fat, cholesterol, total saturated fat, and protein and fat as a percentage of total energy, but they reported a higher intake of carbohydrates, fiber, and carbohydrates as a percentage of total energy. Bedouin women reported lower intake of total saturated fat and percentage of protein and fat and higher intake of carbohydrates and fiber than did Jewish women.

We compared the daily intake of selected nutrients with the dietary reference intake in men and women separately (Figure 1). In Jewish men, vitamins B, C, and A were consumed in sufficient or greater quantities than recommended.<sup>16,17</sup> Both Jewish and Bedouin men reported consuming lower than recommended quantities of vitamin E, calcium, iron (Jews only), and zinc. The pattern among women was similar.

When evaluating the dietary intake of food groups (Table 3), Bedouin men and women ate more complex carbohydrates (bread etc.) but less sweets, vegetables, and dairy products than Jews. Bedouin women ate significantly more legumes than did Jewish women. Since bread was the main contributor to

higher intake of carbohydrates in the Bedouin population, we evaluated its contribution to the total energy intake as well as to selected nutrients such as protein, calcium, iron, and vitamin B1. More than one third of energy and protein intake in the Bedouin population was contributed by bread, as shown in Table 4. Moreover, bread was also the main contributor to the daily intake of iron and vitamin B1.

## DISCUSSION

The Muslim population of the Negev area in the south of Israel is undergoing rapid transition from a rural to an urban lifestyle. Consequently, their dietary pattern has changed dramatically over the last decade, affecting obesity and related morbidity rates. This is the first study since the early 1960s that compared food consumption patterns between Bedouins and Jews; we used an accepted dietary assessment method of an adapted USDA 24-hour recall for each group. The Bedouins in the study were younger and less educated than the Jewish sample. In Bedouins, fat intake was lower than in the Jewish sample, while intake of carbohydrates and dietary fiber were higher. Both samples consumed lower than recom-

mended quantities of calcium and vitamin E.

In this study, BMI in Bedouins was significantly greater than in the Jewish sample, despite the lower mean age of the Bedouins in the study. The rate of obesity (BMI>30) in the Bedouin population was significantly greater than in the Jewish population (28% vs 20%). This finding is in sharp contrast to the finding in 1964 in which obesity was described as a rare condition in Bedouins.<sup>13</sup> In another study of the Bedouin population published in 1990,<sup>18</sup> the authors reported lower rates of obesity than we found. In that publication, 15% of urban Bedouins were obese compared with none in the tribal group. Given the even higher rates of obesity in our study, the rate of obesity in the population appears to be increasing substantially.

Overweight is frequently associated with low socioeconomic status, as has been shown in France, Mexico, Brazil, and Britain.<sup>19-25</sup> Such high rates of obesity may be accounted for in part by poor diet and high carbohydrate intake, mainly from bread, pitas and refined flour. Our findings are similar to those from developing and developed countries<sup>20-28</sup> across the globe, where societies seem to be converging on a diet high in energy from saturated fat, sugar, and refined products.<sup>29</sup> In our study,

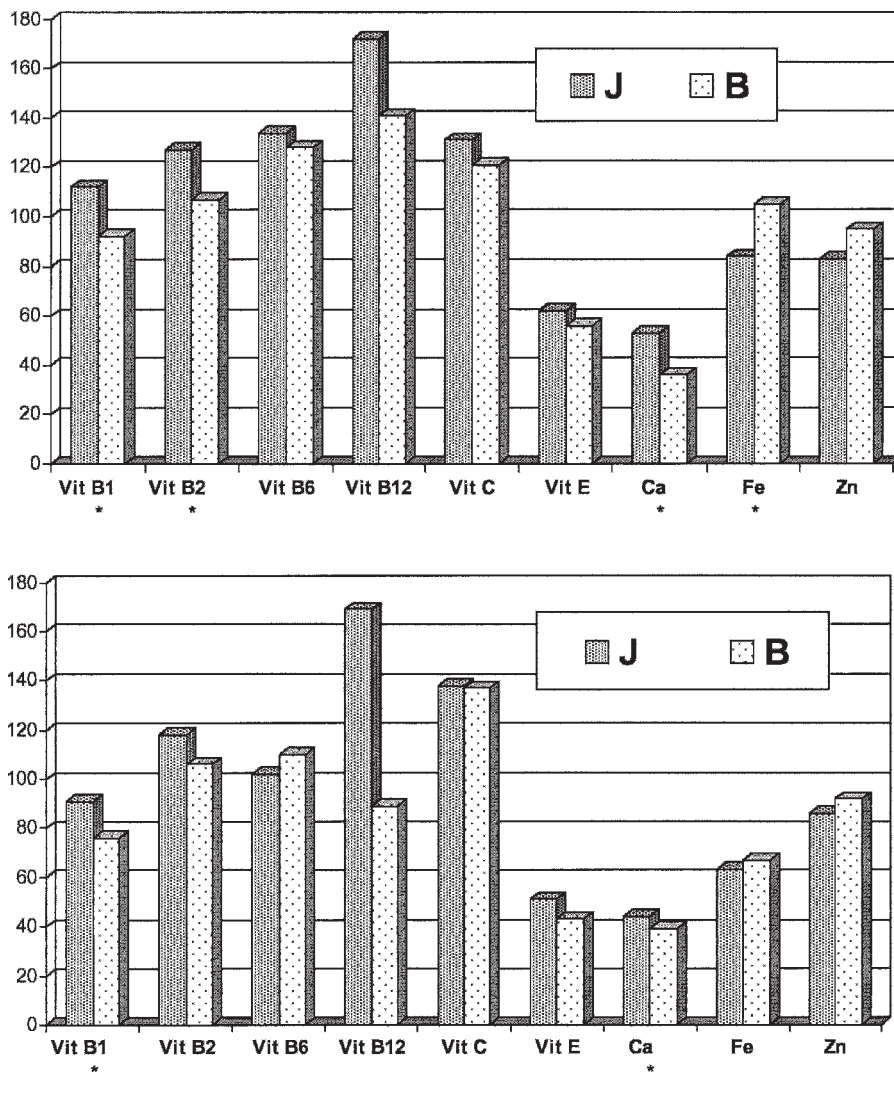


Fig 1. Daily intake of selected nutrient as percent of the Dietary Recommended Intake (DRI) in Jews (J) and Bedouins (B) by sex (\* $P < .05$ ), with rates for men in the upper graph and rates for women in the lower graph.

Bedouins consumed greater quantities of grains and significantly lower quantities of vegetables, dairy products, nuts, sweets, and light drinks than did the Jews. This finding suggests that the main contributors to the excess caloric intake came from refined grains, mainly bread, which is not surprising given the subsidized price of white flour and bread in Israel, and the traditional eating habits of the Bedouin population, which use bread as a utensil.

We found that approximately one third of Bedouin women were obese (36.3% vs 23.2% of Jewish women). In

most Western and modern cultures, overweight, especially in women, is considered unappealing and is associated with increased risk for most chronic diseases.<sup>30</sup> On the other hand, this culture-specific belief is not present to the same extent in Arab Bedouin society. In their culture, given the higher rates of parity, along with Middle Eastern beauty traditions, the ideal feminine figure is fuller.<sup>31</sup> In addition, the Bedouins, especially the women, may not be aware of their obesity, since wearing their traditional long, loose-fitting dresses may prevent

gradual weight gain from being noticed.<sup>32</sup>

Because of Westernization and modernization in Bedouin society in southern Israel, dramatic changes in their dietary patterns have occurred. The traditional diet, which was limited to roughly ground cereals or dried legumes and other durable food products suitable for nomadic desert lifestyle, has changed to a modern, market-based diet. These changes have occurred concurrently with other lifestyle changes related to modernization, eg, extensive use of cars, televisions, and home appliances that diminish physical efforts and energy expenditure required for daily activities.<sup>33,34</sup>

Our results showed that, compared to the adult Jewish diet, the diet of the Bedouins is characterized by a higher percentage of energy from carbohydrates and a lower intake of fat and proteins. In 1964 study, the same pattern of eating was described. Bedouins ate more carbohydrates than did Jews, but they had a lower intake of fats, saturated fat, and cholesterol.<sup>13</sup> That study also showed that 75% of caloric intake were from carbohydrates (62% in our study), 13% from fat (26% in our study), and 12% from protein (14% in our study). Comparing the findings of these two studies, carbohydrate intake among Bedouins has decreased in the past 40 years and fat intake has increased. Similar changes were found regarding cholesterol and saturated fats, a trend described elsewhere.<sup>35</sup>

Even today, bread remains a key food in the Bedouin diet, contributing >30% of energy intake, compared with 17.4% in the Jewish population's diet. As bread is the leading source of energy for this group, enrichment of the flour with vitamins and trace elements may improve diet quality and ensure a diet consistent with recommendations.

Both groups consumed less than the recommended levels of calcium and vitamin E; Bedouins consumed even less than did Jews. In both groups,



**Table 3. Age-adjusted intake of food groups per day per person in grams**

Food group	Males			Females		
	Jews n=348	Bedouins n=56	P	Jews n=445	Bedouins n=113	P
Oils, butter, margarines	7.1 (.7)	6.1 (2.0)	.66	6.3 (.5)	3.9 (1.1)	.05
Alcohol	34.5 (7.3)	.0 (.0)	.10	9.6 (3.0)	.0 (.0)	.08
Legumes	38.3 (5.8)	59.3 (15.3)	.21	21.5 (3.2)	36.7 (6.4)	.04
Complex carbohydrates	289.3 (1.5)	481.5 (27.7)	<.001	209.9 (8.0)	330.2 (16.4)	<.001
Fruits	337.0 (23.4)	282.7 (62.0)	.42	301.8 (17.9)	340.3 (36.5)	.35
Vegetables	279.7 (13.7)	208.1 (36.2)	.07	247.6 (1.5)	208.6 (21.5)	.02
Meat	136.7 (8.1)	128.6 (21.4)	.73	93.4 (5.0)	106.1 (1.3)	.28
Milk & dairy products	206.7 (11.5)	112.3 (3.4)	.005	196.4 (8.6)	121.6 (17.5)	<.001
Fish	21.3 (3.5)	11.5 (9.2)	.33	17.8 (2.3)	8.3 (4.6)	.07
Eggs	22.8 (2.6)	34.0 (6.9)	.14	13.6 (1.6)	23.7 (3.4)	.008
Nuts	12.2 (1.7)	.5 (4.5)	.02	9.0 (1.2)	3.5 (2.5)	.05
Potatoes	58.3 (5.3)	23.5 (14.0)	.02	32.5 (3.2)	34.7 (6.6)	.77
Sweets	26.0 (1.5)	3.8 (3.9)	<.001	19.1 (1.2)	6.0 (2.4)	<.001
Soft drinks	153.8 (2.3)	41.1 (53.8)	.05	85.0 (13.8)	30.3 (28.2)	.09

Values are given as mean (standard error).

calcium intake was drastically lower than recommended. Milk and dairy products were the main contributor to calcium intake. In the Bedouin group, intake of dairy products was significantly lower than in the Jewish group, perhaps due to lack of refrigerators in a high percentage of homes.

A limitation of our study is the use of a one-day 24-hour recall dietary assessment. However, previous publications that were based on a Jewish cohort showed that when using repeated dietary recall, no significant difference between the days was detected.<sup>36</sup> In addition, the dietary assessment was conducted by trained interviewers, using the multi-by-pass method.<sup>37</sup> Because almost all Bedouins are religious and celebrate Ramadan, the exclusion of those interviews did not create sampling bias in Bedouins.

One of the unique features of the present study is the use of dietary assessment methods that enable evaluating individual dietary intake of common-plate eaters. This method was based on the traditional 24-hour dietary recall that was adapted for use among the Israeli population.<sup>38</sup> Earlier studies were less rigorous in assessing nutritional intake among the Bedouins because a proper tool for conducting such assessment did not exist.<sup>39</sup>

Modernization brings about inevitable changes in diet and lifestyle. In the absence of educational intervention, these changes result in increased obesity and morbidity rates. These health consequences are not race- or culture-specific. Data suggest that they may affect populations undergoing nutrition transition even more than Western population.<sup>40</sup>

*We have shown that both Jews and Bedouins have inadequate diets and relatively high rates of obesity.*

We have shown that both Jews and Bedouins have inadequate diets and relatively high rates of obesity. Dietary changes and increased physical activity are recommended as tools in the fight against obesity. They require changes in eating patterns as well as leisure-time activity. These changes may be more easily accepted by the Jewish population but may require innovative approaches in order to adapt them to the traditional diet and customs of the Muslim Bedouin population.

**Table 4. Contribution of bread (as a percent) to selected nutrient intake per person per day in Jews and Bedouins**

Contribution of bread to	Jews (n=571)	Bedouins (n=163)	P
Energy (%)	17.4 (.5)	33.2 (1.1)	<.001
Protein (%)	16.5 (.5)	36.7 (1.6)	<.001
Calcium (%)	5.6 (.3)	16.5 (1.1)	<.001
Iron (%)	23.4 (.6)	37.9 (1.5)	<.001
Vitamin B1 (%)	29.9 (1.6)	51.7 (1.7)	<.001

Values are given as mean (standard error).

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