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Growth Abnormalities in Mexican-American
Children in the United States:
The National Health and Nutrition
Examination Survey I Study

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Fernando S. Mendoza, M.D., M.P.H.
Ricardo O. Castillo, M.K., M.P.H.
Department of Pediatrics
Stanford University Medical Center
Stanford, CA 94305

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Stanford Center for Chicano Research, Cypress Hall, E-7, Stanford, CA 94305

ABSTRACT

Numerous regional studies have indicated a high prevalence of growth abnormalities among Mexican-American children. It has been suggested that this is a constitutional problem. In order to evaluate this, a comparison of selected parameters of growth and nutritional status were made between Mexican-American and European-American children (19 years) using the National Health and Nutrition Examination Survey I. Height, Weight, body mass index (BMI) and daily dietary energy intake were standardized for age and sex, and compared using analysis of variance techniques. Socioeconomic status was analyzed by utilizing a poverty index. Our results show that 10 percent of MA children fall below the 5th percentile for height while weight is normally distributed. On analysis by SES, low SES MA children were dramatically stunted and exhibited marked evaluations in BMI in comparison to low SES EA children. These differences diminished with increasing SES so that a high SES, no differences in height or BMI were noted. While no differences in weight within SES categories were demonstrated between MA EA children, there was a distinct trend toward increasing weight with increasing SES. MA children demonstrated a difference in caloric intake as compared to EA children only at low SES. The observation that abnormalities in growth seen in MA children at low SES levels disappear at higher SES levels suggests that growth abnormalities among MA children are due to environmental as opposed to genetic factors.

KEY WORDS: Mexican-American, nutritional status, anthropometry

INTRODUCTION

Numerous investigations of growth patterns of Mexican-American children have consistently shown that Mexican-American children are significantly shorter than children in the general U.S. population (1-12). This has resulted in speculation that the genetic potential for growth may differ for children of Mexican-American descent. However, all previous studies have drawn their samples from small geographical units, such as the area of influence of a public health clinic or a specific community. Even though one study was based on data from the Ten-State Survey (11), the low compliance rate of Mexican-Americans with the survey, the lack of an appropriate ethnic identifier for Mexican-Americans, and the fact that only two of the five southwestern states were surveyed limited the sample size, geographical representativeness and usefulness of the Ten-State Survey data obtained from Mexican-Americans.

Another major limitation of previous studies is that many have focused on Mexican-American populations of low socioeconomic status and, therefore cannot be used to investigate the effect of socioeconomic status on the parameters of growth. Because a relationship between socioeconomic status, growth and maturational patterns has been found in other populations (10, 11), there is a need for studies of the growth patterns of Mexican-American children that use samples representative of all regions of the United States containing the major population concentrations of Mexican-Americans and that include subjects of all socioeconomic strata. The National Health and Nutrition Examination Survey I (NHANES I, 1971-1973) provides data which largely satisfy these requirements. This health and nutrition survey was based on complex national probability sample of the population of the United States (13). The data collected include extensive anthropometric, nutritional, biochemical, medical and socioeconomic information. Although the NHANES data have been used to examine the health status of children in the United States in general, the subset of Mexican-American children in NHANES has not been analyzed separately. This is a report of the first examination of the growth and nutritional status of Mexican-American children based on the data collected in NHANES I.

METHODS

The subjects of our study were all children in NHANES I less than 19 years of age. Ethnicity was defined by means of responses to survey questions about national origin or ancestry (question 9), and the use of Spanish at home (question 8). Subjects were grouped according to their responses to these questions. Those listing Mexican as their ancestry or national origin were placed into the group labeled Mexican-American (MA). Eighty-nine percent of these subjects spoke Spanish and inspection of geographic distribution showed that the Mexican-

American group was located almost entirely (95%) in the western United States, providing a gross validation of the means used for ethnic identification. All children of European-American ancestry, including those of German, Irish, Italian, French, Polish, Russian, English, Jewish, and American ancestry were placed in the group labeled European-American (EA). Also included in this group were those children who were observed to be white in race but listed "Other" in ancestry and were not Hispanic. This latter group, we believe, added those of other European countries not listed and those who were of mixed racial background but primarily appeared white or European. This resulted in a sample size of 328 for the MA group and 4602 for the EA group.

Socioeconomic status was defined by means of the Poverty Index (P.I.) which was developed from a Poverty Income Ratio (P.I.R.). The ratio was derived from the total family income divided by the income necessary to maintain a family with given characteristics on a nutritionally adequate food plan. The denominator is based on the Consumer Price Index and reflects the accrual cost of living. A family income level resulting in a P.I.R. of 1 is at the poverty level while a ratio of 2 results from a family income twice the poverty level. The Poverty Index, therefore, provides an assessment of economic status. The distribution of the head of household's Poverty Index among the families of the Mexican-American children was roughly one-third less than a ratio of 1, one-third with ratios from 1 to 1.6 and one third with ratios greater than 1.6. These three categories of Poverty Index: low (<1), mid (1-1.6), and high (>1.6) were used to stratify the sample groups into analogously labeled socioeconomic levels.

Growth percentiles for height, weight, and Z scores for height and weight were determined for each subject using the computer program, "Normalized NCHS/CDC Anthropometric Reference," written by the National Center for Health Statistics and the Center for Disease Control, and based on the anthropometric data from NHANES II and the Fels Research Institute (14). A Z score of 0.0 is equivalent to average growth, positive values indicate above average and negative values below average growth. A body mass index ($BMI = wt/ht^2$) standardized for age and sex to assess leanness-fatness and a 24-hour recall of total caloric intake standardized for age and sex were also assessed for each subject. Both standardized scores were standardized against the total EA group. The Poverty Index of the family of each subject was also obtained.

All Mexican-American children were compared against age specific growth norms using the NCHS/CDC computer program. Sexes were pooled in order to increase the size of the samples. The MA and EA groups were stratified by socioeconomic status (SES) using the Poverty Index noted above. Differences between groups within SES categories, as well as differences within groups across SES

categories were evaluated by means of ANOVA utilizing the survey sample weights (15).

The complex study design factor was not used in the analysis since this study was exploratory in nature. However, the level of significance for this study was taken as $P < .01$ in order to limit the number of significant findings due to chance occurrence.

RESULTS

Table 1 shows a summary of the data for each group as well as for each SES subgroup. Sample sizes for anthropometric measures varied because of missing data. Sample sizes for caloric Z scores were larger because they were obtained from the household questionnaire instead of the physical examination section. The EA group's mean height and weight Z scores were 0.03 and 0.04 respectively. In contrast, the mean height Z score for the MA group was -0.40 which was significantly different from their EA counterpart ($P < .001$) with 10 percent of the MA group falling below the 5th percentile for height. The mean weight Z score was 0.02 for MA, which was the same as the EA group, and was normally distributed across percentiles.

Analyzing the two sample groups by socioeconomic status (low, mid, high) provided a way to examine the individual effects of ethnicity and socioeconomic status on the growth parameters of the children. Figure 1 shows the mean height Z scores at each SES level. In the low SES group, MA had a mean height Z score (-0.72) that was significantly lower than EA (-0.30) as determined by ANOVA ($P < .0001$). At this SES level, MA showed more stunting in their height than did their European-American counterparts. Though less striking, a strong trend was still present in the mid SES group ($P < .02$), while in the high SES group, no differences were found. Both groups showed dramatic increases in height with increasing socioeconomic status ($P < .0001$).

No significant differences in weight between MA and EA were found at any socioeconomic level (Figure 2). Intragroup comparisons demonstrated socioeconomic differences in weight in EA ($P < .0001$), with those children in the high socioeconomic group weighing more than children below the poverty line ($Z = 0.09$ and -0.18). Among the group of Mexican-American children, no significant differences due to SES could be demonstrated, perhaps secondary to small sample sizes. Of note is that individuals below the poverty line had a mean weight Z score of -0.12 while individuals in the high SES group had a mean weight Z score of 0.25.

The body mass index (BMI) showed a significant intergroup difference in the low SES category ($P < .0001$) where MA had a greater standardized mean BMI ($Z = 0.42$) than EA ($Z = -0.03$)

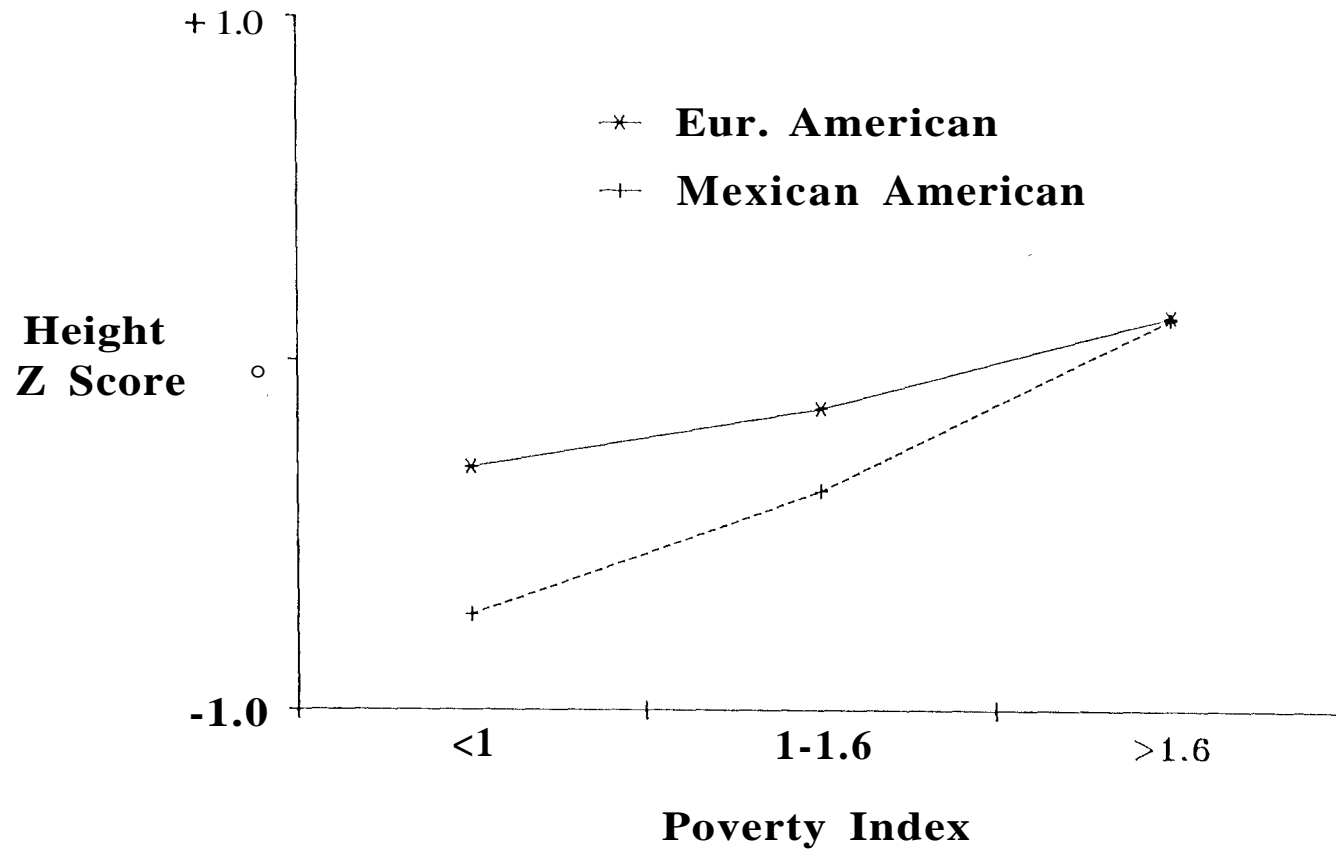
TABLE 1

Anthropometric and Nutritional Data by Ethnic and Socioeconomic Groups

Group/SES	Mean P.I.	n*	Ht Z	sd	Wt Z	sd	BMI Z	sd	n	Cal Z	sd
EA: TOTAL	2.43	4403	0.03	1 .00	0.04	1.06	0.00	1 .00	4602	0.00	1.00
LOW	.69	516	-0.30	0.84	-0.18	0.94	-0.03	0.93	548	0.03	1.11
MID	1.33	832	-0.14	0.95	-0.03	1 .02	0.02	0.96	863	-0.02	1 .00
HIGH	2.93	2954	0.12	1 .01	0.09	1 .09	0.00	1 .02	3081	0.00	0.97
MA: TOTAL	1.32	310	-0.40	1 .06	0.02	1.10	0.33	1 .23	328	-0.10	0.98
LOW	.64	127	-0.72	1.09	-0.12	1 .08	0.42	1 .14	134	-0.22	0.85
MID	1.31	106	-0.37	1 .00	0.04	1 .21	0.36	1.47	111	-0.06	1.12
HIGH	2.55	n	0.12	0.92	0.25	0.97	0.13	0.99	77	0.01	1.00

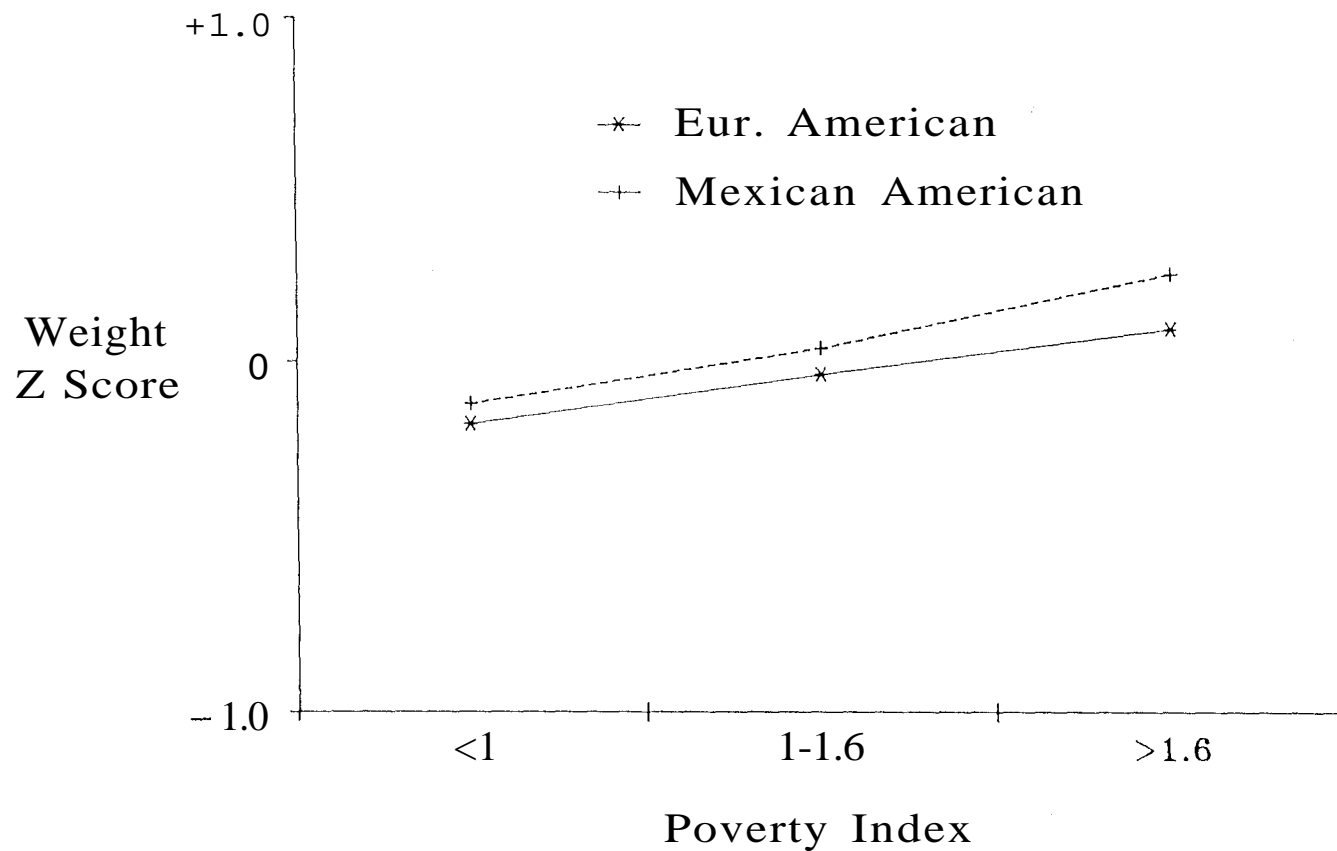
* Sample size varied because of missing data.

FIG. 1
Mean height Z score by ethnic group at each SES level



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FIG. 2
Mean weight Z score by ethnic group at each SES level



(Figure 3). There was also a significant difference in BMI between these groups at the mid SES group with MA $Z = 0.36$ and EA $Z = 0.02$ ($P < .002$). This difference disappeared in the high SES groups. Within sample groups, no significant differences in BMI were found across socioeconomic levels but a trend toward decrease in BMI with increasing SES clearly is evident in MA.

The standardized 24-hour caloric intakes showed a strong trend toward group differences only at low SES with a MA mean Z score of -0.22 and EA mean Z score of 0.03 ($P < .02$) (Figure 4). Examination of SES and caloric intake showed that there was no differences in caloric intake with increasing SES level for both EA and MA (F values 0.33 and 1.55 respectively).

The mean poverty index for each group was determined. In the low SES level, the mean P.I.s for EA and MA groups were 0.69 and 0.64 . These were significantly different ($P < .01$). At the mid SES level, the mean P.I.s were not significantly different, while at the high SES level they were ($P < .01$).

DISCUSSION

Although these studies of the NHANES I data were exploratory in nature, striking differences in height and body mass index were found to exist between Mexican-American and European-American children of low socioeconomic status. These differences dramatically disappear with improvement in socioeconomic status and, in fact, a gradient of decreasing differences with increasing SES is clearly evident (Figure 1 and Figure 3).

The marked rate of rise in height of Mexican-American children with improving socioeconomic status is particularly dramatic. In Lowenstein's review of the nutritional status of Spanish Americans, the prevalence of stunting in height, (percent of the population below the third percentile), was as high as 20 percent (8). More recently, Dewey, in a comparison between migrant and nonmigrant Mexican-American children between 1-11 years of age, found that migrant children were shorter than the U.S. norms while nonmigrant children were very close to the U.S. norm in height, suggesting a major influence of environment on height (12). Our study supports and extends this concept by demonstrating that poverty, defined by a Poverty Index Ratio of less than one, is clearly associated with stunting in a national sample of Mexican-American children.

Although weight differences between children of low and high SES were noted (Figure 2), it is of interest that no differences between Mexican-American and European-American children were found. In Mexican-American children of low SES, the combination of low height attainment and comparatively normal body weight implies a "short and stocky" body habitus. This short and stocky physique has been found in other studies of Mexican-American children, suggesting that excess weight may be a problem for this

FIG. 3
Mean BMI Z score by ethnic group at each SES level

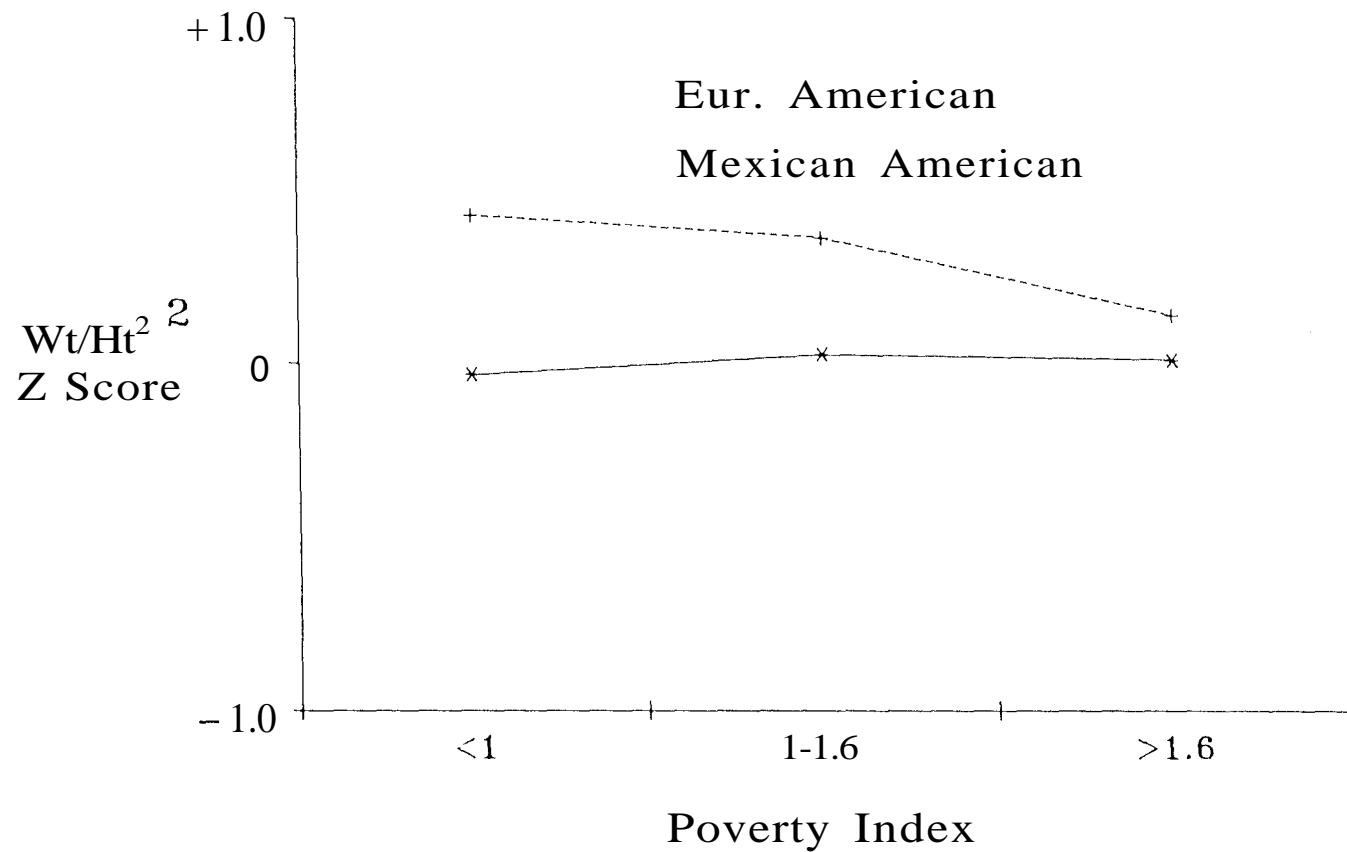
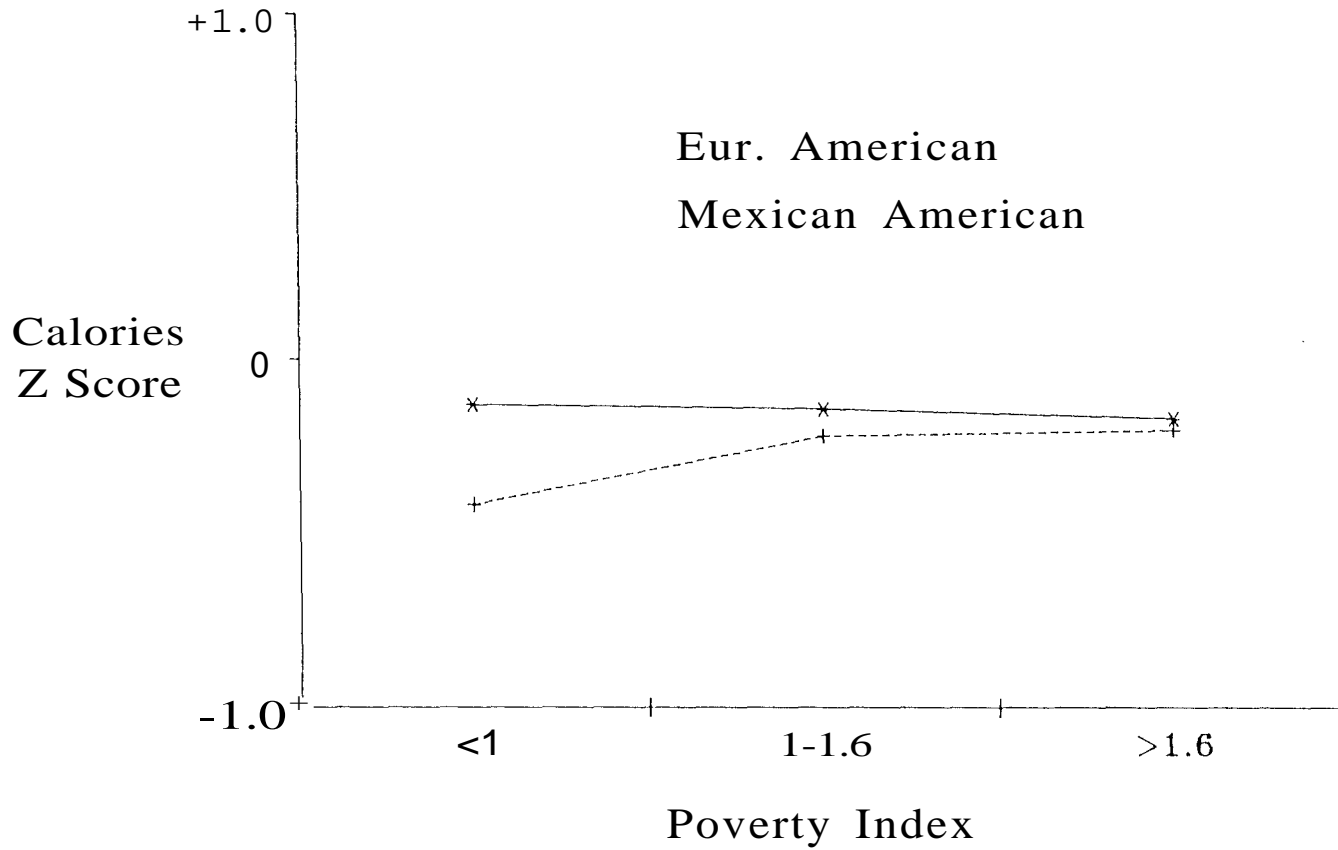


FIG. 4
Mean calorie Z score by ethnic group at each SES level



population of children (4,7,10). In this study, a standardized BMI was used to assess leanness-fatness. Within the limits of this measure, Mexican-American children of low SES appear to have a greater degree of fatness suggesting a greater degree of overweight in comparison to European-American children of low SES. The fall in BMI among Mexican-American children with improving socioeconomic status (Figure 3) is of considerable interest, particularly since parallel changes in BMI were not present in European-American children.

Because dietary inadequacy has been commonly implicated as a cause of abnormalities in growth, we compared the 24-hour recall of caloric intakes of Mexican-American and European-American children (Figure 4). The difference in 24-hour caloric intakes between these two groups in the low SES level suggests that poorer caloric intake may contribute to shorter stature of Mexican-American children. This difference in dietary intake disappears above the poverty line as do most of the growth differences. Apart from concern regarding the accuracy of the 24-hour recall dietary intake history in general (16,17), some inaccuracies probably occurred in collection of dietary data from NHANES I Mexican-American families because questionnaires were not systematically translated into Spanish. Although analysis of total caloric intake has suggested some differences may exist, differences in protein, carbohydrate and lipid consumption and food choices are also likely to impact upon the growth of MA children. We are currently investigating these areas.

These studies show, for the first time, that significant differences exist within the population of Mexican-American children in the U.S. The striking differences in height and body habitus between Mexican-American children of low SES and high SES suggest a highly heterogeneous population which is not evident from previous studies. Moreover, when compared to EA children in the low SES group, MA children tend to be poorer. This may be the reason for the interethnic group differences seen in this study. Although a larger and more complete data set is required for confirmation and extension of these findings, the disappearance of abnormalities in growth seen in Mexican-American children of high SES when compared to low SES suggests these abnormalities are not due to differences in genetic potential but rather to environmental factors.

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REFERENCES

1. CHASE, H.P., KAUMAN, V., DODDS, J.M., SAUBERLICH, H.E., HUNTER, R.M., BURTON, R.S. and SPALDING, V. Nutritional status of prereschool Mexican-American migrant farm children. Amer. J. Pis. Child. 122: 316-324, 1971.
2. LARSON, L.B., DODDS, J.M., MASSOTH, D.M. and CHASE, H.P. Nutritional status of Mexican-American migrant families. J. of the Amer. Dietetic Assoc. 64; 29-35, 1974.
3. ACOSTA, P.B., ARANDA, R.G., LEWIS, J.S. and READ, M. Nutritional status of Mexican-American preschool children in a border town. The Amer. J. of Clin. Nutr. 27: 1359-1368, 1974.
4. YANOCHIK-OWEN, A. and WHITE, M. Nutritional surveillance in Arizona: Selected anthropometric and laboratory observations among Mexican-American children. AJPH 67(2): 151-154, 1977.
5. DUNCAN, B., SMITH, A. and BRIESE, F. A comparison of growth: Spanish-surnamed with Non-Spanish-surnamed children. AJPH 69(9); 903-907, 1979.
6. ZAVALETA, A. and MALINA, R. Growth, fatness, and leanness in Mexican-American children. The Amer. J. of Clin. Nutr. 33; 2008-2020, 1980.
7. KAUTZ, L. and HARRISON, G.G. Comparison of body proportions of one-year-old Mexican-American and Anglo children. AJPH 71(3): 280-282, 1981.
8. LOWENSTEIN, F.W. Review of the nutritional status of Spanish Americans based on published and unpublished reports between 1968-1978. Wld. Rev. Nutr. Diet 37: 1-37, 1981.
9. 10-State Nutrition Survey 1968-1970. DHEW Publication (HSM) 72-8130-34.
10. LOWE, C., FORBES, G., GARN, S., OWEN, G., SMITH, N., and WEIL, Jr., W. Committee to review the Ten-State Survey, a pediatric perspective. Pediatrics 51(6); 1095, 1973.
11. GARN, S. and CLARK, D. Nutrition, growth, and maturation findings from the Ten-State Nutrition Survey of 1968-1970. Pediatrics 56(2); 306, 1975.
12. DEWEY, K., STRODE, M. and FITCH, Y. Anthropometry of nonmigrant Mexican-American children and adults in northern California. Ecology of Food and Nutr. 14; 25-35, 1984.

13. Plan and operation of the health and nutrition examination survey, U.S. 1971-1973. Vital and Health Statistics Series 1, No. 10 b., DHEW (PHS) 79-1310.
14. Normalized NCHS/CDC anthropometric reference through courtesy of N. Staehling and E. Borland; Center for Disease Control: CHPE Division of Nutrition, Statistics, Atlanta, Georgia.
15. A statistical methodology for analyzing data from a complex survey. The First National Health and Nutrition Examination Survey, NCHS DHHS Pub. No. CPHS1 82-1366.
16. CARTER, R., SCARBOUGH, C. and STAPELL, C. Reliability and validity of the 24 hour recall. J. of Amer. Dietetic Assn. 79: 542-552, 1981.
17. KARBETTI, R and KNUTS, L. Agreement between dietary interviews. J. of Amer. Dietetic Assn. 79: 654-667, 1981.