PREDICTIVE MEDICINE. VIII. FAMILIAL VERSUS GENETIC FACTORS

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ABSTRACT: **Though genetic factors influence health and disease, they are involved less often than supposed. Environmental factors possibly may be an "overlay" in genetic problems. There is reasonable evidence that the environment plays a role in diet, enzymes, the biochemical state, and the clinical picture. Supportive data are presented showing statistically significantly correlations in married couples (who seldom are genetically linked).**

More emphasis should be placed on environmental factors in predictive medicine programs. Although it may be difficult to alter the environment, it is not as difficult as trying to alter the genetic state.

> . . . Except for a comparatively few and rare hereditary diseases, life experiences, rather than inherited characteristics, may be the primary factors making one individual significantly different from the next . . .
>
> *Knobloch and Pasamanick*

The foregoing citation (1), representative of many, points out that more attention must be directed to environmental forces in the genesis of disease. Incidentally, this approach also minimizes the element of hopelessness engendered when diseases are ascribed to purely hereditary factors.

This, the eighth in a series of reports (2), is designed to demonstrate another unique feature of a predictive medicine program—the importance of environmental influences in a number of diagnostic areas usually not regarded as related to the environment.

DIET AND ENVIRONMENT

The importance of diet in predictive medicine will be dealt with in later reports (3). For the present, it is relevant to examine the diet in relation to the environment.

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TABLE 1
Correlation Coefficients for Daily Consumption of Refined Carbohydrates

	Number of Pairs	r	P
Husband vs. wife	82	+0.520	<0.01*
Husband vs. unrelated female	82	+0.002	>0.05
Wife vs. unrelated female	82	−0.078	>0.05
Husband vs. wife:			
(husband's age <41)	40	+0.442	<0.01*
(husband's age 41+)	42	+0.669	<0.01*
Husband vs. unrelated female:			
(husband's age <41)	40	+0.109	>0.05
(husband's age 41+)	42	−0.094	>0.05
Wife vs. unrelated female:			
(age <40)	43	−0.105	>0.05
(age 40+)	39	−0.015	>0.05

* Statistically significant.

●○ entire sample   r = + 0.520   P < 0.01
○ husband's age <41   r = + 0.442   P < 0.01
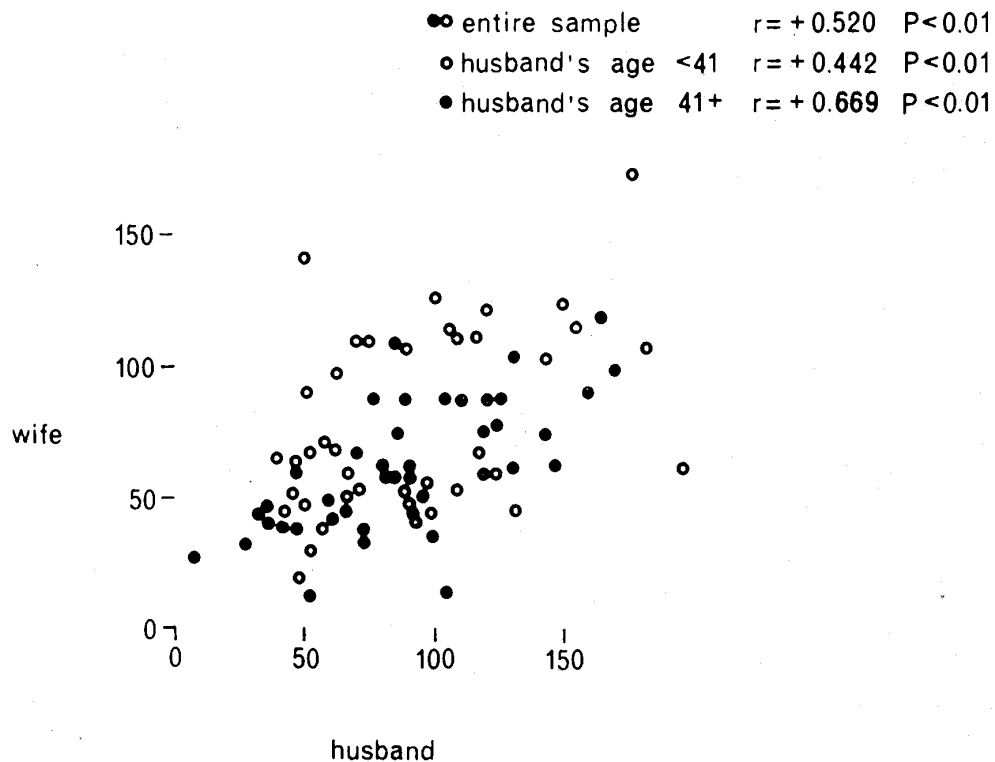● husband's age 41+   r = + 0.669   P < 0.01

Fig. 1. Relationship of the daily consumption of refined carbohydrates (grams) in 82 husbands versus their 82 wives. For the entire sample, the correlation coefficient (r = +0.520) was highly significant (P < 0.01). The correlation coefficient was even higher (r = +0.669, P < 0.01) for the older married couples.

The daily consumption of refined carbohydrates was determined from a seven-day dietary survey of a group of 82 dentists, their 82 wives, and 82 wives of other dentists age-paired against the wives of the dentists in this study (4). Table 1 shows that there was a statistically significant correlation [r = +0.520, P <0.01] only between the married couples. An analysis also was made of the data on younger and older couples (Table 1). The correlation coefficient was higher (r = +0.652) for the older couples. Within the limits of such a study it seemed reasonable to conclude that, with advancing age, couples tend to choose similar dietary components with regard to refined carbohydrate foods (Fig. 1). Essentially the same type of relationship was found to apply to total carbohydrates (4a), total calories (4b), fats (4c), proteins (4d) and vitamin-A consumption (5).

Environmental influences seemed to play a significant role in these dietary patterns, since the partners in most of the marriages were not genetically related.

ENZYMES AND ENVIRONMENT

By means of the same format, data were collected on 48 dentists, their 48 wives, and 48 wives of other dentists age-paired against the wives in the study, with regard to serum glutamic oxalacetic transaminase (SGOT) levels (6a) (Table 2). The pattern of findings for this particular enzyme was almost similar to that for dietary habits. There were, however, two differences: 1) the enzyme correlations were much higher, and 2) with advancing age, they did not increase. Nonetheless, the familial patterns for SGOT were significant (Fig. 2). Similar findings were noted with respect to lactic dehydrogenase (LHD) (6b).

Thus environmental factors also influence enzyme levels, since genetic

TABLE 2
Correlation Coefficients for Serum Transaminase (SGOT) Levels

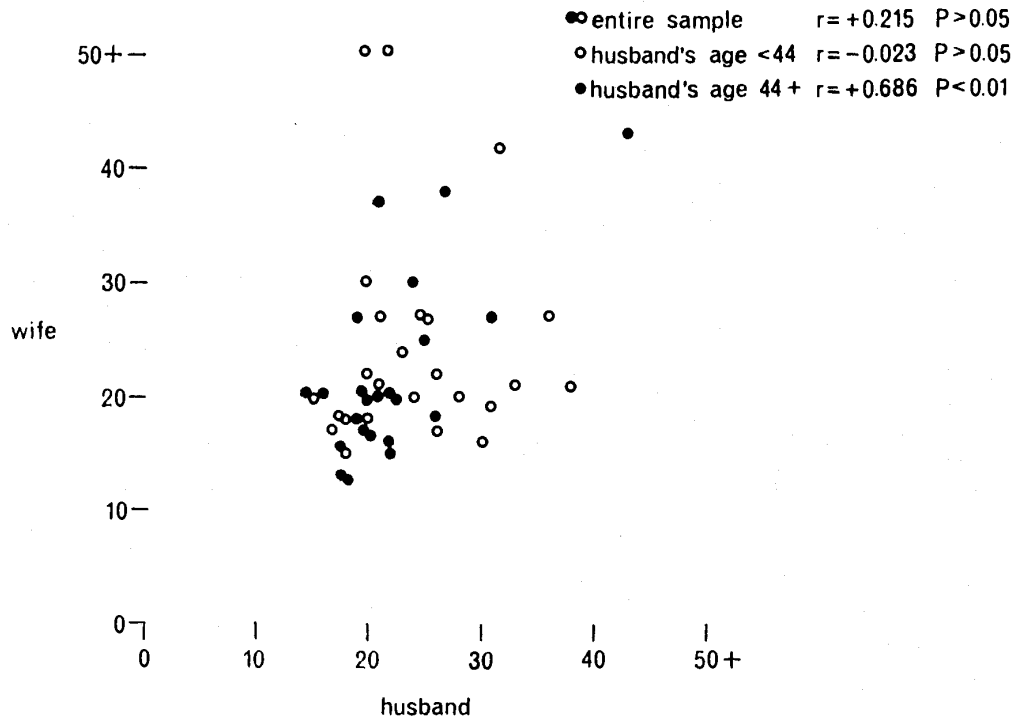|	Number of Pairs	r	P
Husband vs. wife	48	+0.215	>0.05
Husband vs. unrelated female	48	+0.132	>0.05
Wife vs. unrelated female	48	−0.050	>0.05
Husband vs. wife:			
(husband's age <44)	25	−0.023	>0.05
(husband's age 44+)	23	+0.686	<0.01*
Husband vs. unrelated female:			
(husband's age <44)	25	+0.258	>0.05
(husband's age 44+)	23	−0.058	>0.05
Wife vs. unrelated female:			
(age <43)	22	−0.071	>0.05
(age 43+)	26	−0.123	>0.05

* Statistically significant.

FIG. 2. Relationship of serum glutamic oxalacetic transaminase (SGOT) levels in 48 husbands versus their 48 wives. For the entire sample, the correlation (r = +0.215) was not significant (P > 0.05). The correlation coefficients for the younger and older couples were markedly different. There was a statistically significant correlation coefficient (r = +0.686, P < 0.01) for the older married group.

TABLE 3
Correlation Coefficients for Serum Cholesterol Levels

	Number of Pairs	r	P
Husband vs. wife	196	+0.367	<0.01*
Husband vs. unrelated female	196	+0.085	>0.05
Wife vs. unrelated female	196	+0.271	<0.01*
Husband vs. wife:			
(husband's age <41)	99	+0.196	>0.05
(husband's age 41+)	97	+0.440	<0.01*
Husband vs. unrelated female:			
(husband's age <41)	99	+0.012	>0.05
(husband's age 41+)	97	+0.016	>0.05
Wife vs. unrelated female:			
(age <39)	96	+0.129	>0.05
(age 39+)	100	+0.209	<0.05*

* Statistically significant.

variables did not pertain to the circumstances of this study with regard to married couples.

BIOCHEMICAL FACTORS AND ENVIRONMENT

Table 3 summarizes the serum cholesterol values in 588 subjects grouped as previously reported for diet and enzyme studies (7). Again, there was a significant correlation only for the married couples (Fig. 3), and the correlation became more significant with time. Similar observations have been made for serum albumin (8), blood glucose (9) and, in smaller samples, for serum cholesterol (10).

This is additional evidence, in the biochemical scheme, of the effect of the environment.

CLINICAL STATE AND THE ENVIRONMENT

Environmental effects may also be noted at the clinical level. Fifty-four men, their 54 wives, and 54 other women age-paired against the wives were studied in terms of clinical scores as determined by the Cornell Medical Index Health Questionnaire (CMI) (11). Table 4 outlines the relationships. The pattern was quite similar to that for diet, enzymes, and biochemical levels. There was a statistically significant correlation for the
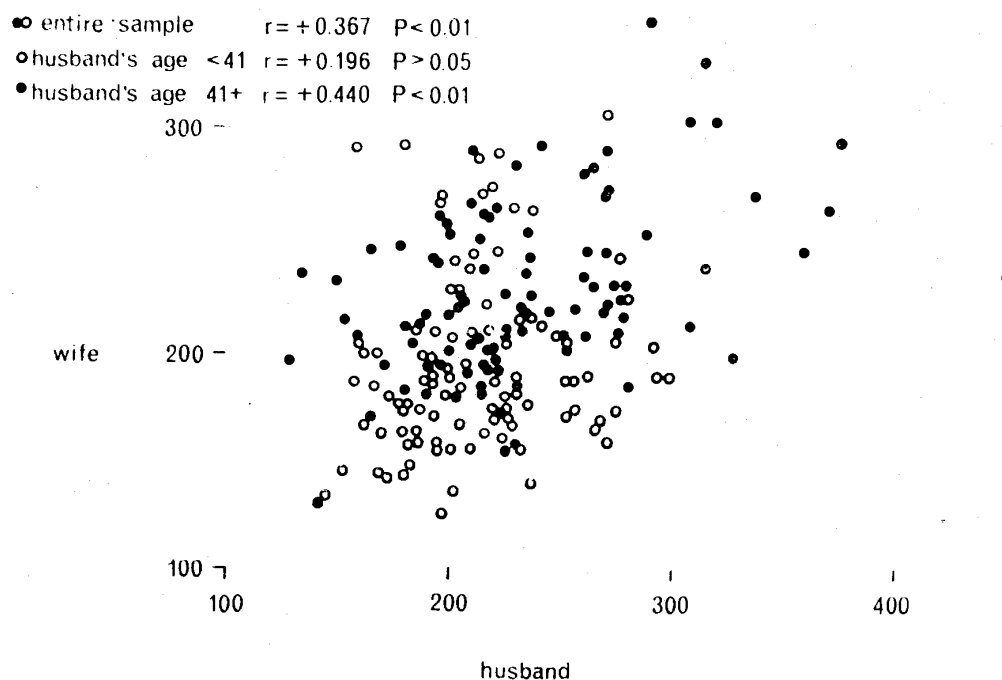

FIG. 3.   Relationship of serum cholesterol levels (mg per 100 ml) in 196 husbands versus their 196 wives. For the entire sample, the correlation coefficient (r = +0.367) was significant (P < 0.01). The correlation coefficient was even higher (r = +0.440, P < 0.01) for the older married couples.

TABLE 4
Correlation Coefficients for Clinical Symptoms and Signs

	Number of Pairs	r	P
Husband vs. wife	54	+0.522	<0.01*
Husband vs. unrelated female	54	+0.122	>0.05
Wife vs. unrelated female	54	+0.117	>0.05
Husband vs. wife:			
(husband's age <40)	27	+0.373	>0.05
(husband's age 40+)	27	+0.689	<0.01*
Husband vs. unrelated female:			
(husband's age <40)	27	+0.249	>0.05
(husband's age 40+)	27	—0.038	>0.05
Wife vs. unrelated female:			
(age <40)	35	+0.186	>0.05
(age 40+)	19	—0.247	>0.05

* Statistically significant.

∞ entire sample   r = +0.522   P<0.01
○ husband's age <40   r = +0.373   P>0.05
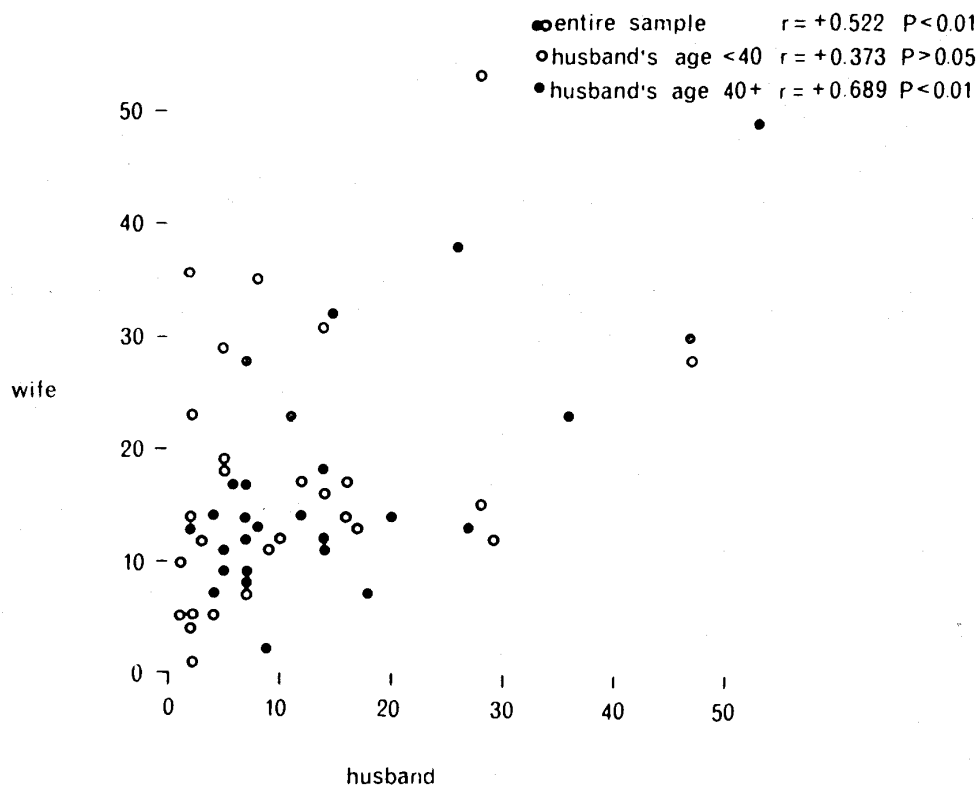**●** husband's age 40+   r = +0.689   P<0.01

wife

husband

FIG. 4. Relationship of the frequency of reported clinical symptoms and signs (Cornell Medical Index scores) in 54 husbands versus their 54 wives. For the entire group, the correlation coefficient ($r = +0.522$) was significant ($P < 0.01$). The correlation coefficient was even higher ($r = +0.689$, $P < 0.01$) in the older married couples.

married couples, and the correlation increased with age (Fig. 4). These clinical parallelisms have been noted previously with regard to overall symptoms and signs in a larger group (12), and also with regard to psychic findings (13).

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