his own ability, for his own comfort and success.

We cannot help the worker to make better use of his capacity and abilities unless we clearly understand the problems confronting men and women as they enter our complex social-industrial world. It is well, I think, to ask, "What does the worker bring to the job?" He brings his heredity, his health, his behaviour habits, his social attitude, and his emotional reactions. "How is the worker different from each other worker?" To begin with, the worker is the product of his particular type or kind of heredity. This means that physically, his organic function, his physiological make-up is at a particular level, a particular state of health. His heredity also pre-determines his intelligence, his capacity, and his skill. He comes from a particular type of home which has conditioned him in certain fundamental behaviour habits. His degree of emotional stability, his social attitude, have been pre-determined by parental influence, and by the influences of neighbourhood, school, and church. The quality or degree of self-reliance, initiative, response to authority, and his sense of personal responsibility, ethics and morals have been given direction by his early environment.

These are the things the worker brings to the job. In the degree in which he possesses these factors, he differs from every other individual. These are the factors that must be clearly understood, properly analyzed, and accurately evaluated. To properly measure and evaluate these factors or variations in their degree, new techniques are required, not the techniques based upon logic, mathematics, or chemical formulæ, not the techniques used in machine design, machine maintenance, planning and scheduling, and production. We need human techniques that can measure, evaluate and treat human factors such as attitudes, emotional responses, in short, the factors of human behaviour.

REFERENCES

1. SAPPINGTON, C. O.: Essentials of Industrial Health, J. B. Lippincott, Phila., 1943.
2. MCCORD, C. P.: Industrial Hygiene for Engineers and Managers, Harper & Brothers, New York, 1931.
3. GIBERSON, L. G.: Manual of Industrial Hygiene, Saunders, Phila., 1943.

The fundamentals of tuberculosis control are changed by neither war nor peace. They always are: Find the sick—treat the patient—restore his earning power—prevent the spread of the disease—keep the family together.—Kendal Emerson, M.D.

DIETARY STUDY OF TORONTO SCHOOL TEACHERS*

By J. H. Ebbs, M.D., F. F. Tisdall, M.D. and Marjorie L. Scott, M.Sc.

Toronto

IN the early part of 1941 a committee was formed, composed of representatives of the Toronto Board of Education, the Toronto Teachers' Council, and the Department of Pædiatrics, University of Toronto, to plan a dietary study of a group of teachers. The objects of this study were as follows: (1) To determine whether or not the diets of the teachers could be improved. (2) To observe the influence in one group of teachers of any improvement of dietary habits upon the health, the number of illnesses suffered, and the number of days of absence from school due to illness. (3) To observe the influence of vitamin-mineral pills upon the health and days of absence in another group of teachers. (4) To compare the two groups with respect to the number of new cavities in the teeth. (5) To compare the health and dental records with a third group which received neither diet advice nor pills. (6) To create among the teachers an interest in nutrition and through them increase the knowledge of nutrition of a large group of school children, who would in turn probably exercise an influence on the home dietary picture.

One thousand teachers volunteered to take part in the study, dividing themselves into two groups: Group I, those wishing to improve their diets if possible, and Group II, those desiring to take vitamin-mineral pills. At group meetings, instructions were given for the recording of a detailed food diary for one week. At the same time information was recorded by each teacher regarding the source of meals, *i.e.*, home, boarding-house or restaurant, whether on a special diet, whether receiving medical treatment, whether taking any vitamin preparations, whether the general health could be considered "good", "fair" or "poor". Illness suffered during the year previous to the commencement of the study, with duration and number of days absent from school was also recorded. Height and weight were obtained by the individual teacher. The number of teeth removed, the

* From the Department of Pædiatrics, University of Toronto and the Hospital for Sick Children, Toronto, under the direction of Alan Brown, M.D., F.R.C.P.(Lond.).

total number with dental fillings, and the number of fillings in the year previous to the commencement of the study were recorded. Each teacher was asked to keep a record of the number of colds and other illnesses, with duration, including those which did not cause absence, also the number of days absent from teaching for each illness, and a dental record during the year of study (May, 1941 to May, 1942).

The dietary record for one week and the above information were sent to the Department of Pædiatrics, under a code number, known only to a representative in each school. The school as well as the individual teacher was given a code. The food-records were quickly analyzed, and a food score or rating was sent to each teacher showing their average food intake in comparison with the recommended food intake for each of five main groups, namely, dairy products, vegetables, fruits, cereals and meat (Fig. 1).

The score sheet sent to Group I, showing the score obtained in comparison with the score if satisfactory, was supplemented with specific statements pointing out what should be done to improve the score. No instructions were given to Group II, who were supplied with a vitamin-mineral preparation* containing the following daily amounts:

Vitamin A—10,000 international units.
Vitamin D—1,750 international units.
Vitamin E—As contained in 2½ oz. whole wheat.
Vitamin B_1—222 international units (0.67 mgm.).
Vitamin B_6—25 gamma.
Nicotinic acid—10 mgm.
Riboflavin—100 gamma.
Vitamin C (ascorbic acid)—300 international units (15 mgm.).
Ferrous sulphate exsiccated—1½ grains (100 mgm.).
Dibasic calcium phosphate—1½ grains (100 mgm.)
Also traces of copper, manganese and iodine.

In October, 1941, a second food record was obtained for one week from Groups I and II. This was analyzed and another food score sheet was sent to each teacher with instructions to those in Group I who could further improve their diets.

At the end of the year of study (May, 1942), a third food record was obtained from Group I

* The vitamin-mineral preparation used was Alphamin, manufactured by Ayerst, McKenna & Harrison Limited, of Montreal, Que., and Rouses Point, N.Y.

FIGURE 1.

SCORING OF YOUR FOOD INTAKE IN COMPARISON WITH A SATISFACTORY FOOD INTAKE

Food group	*Score if satisfactory*	*Score obtained*
1. Dairy products.		
(*a*) Milk—15 oz. including that used in the cooking. Cream scores as milk. One helping of cheese scores as 4 oz. of milk. One ounce of milk makes 6 points in the score. Under certain circumstances a good excess of milk may make up for a deficiency of the B group of vegetables.	100%	
and		
(*b*) Butter—2 oz. including that used in cooking. 1 oz. scores as 5 points.		
2. Vegetables.		
One serving averages 3 to 4 ounces.		
(*a*) 1 serving of potatoes		
and		
(*b*) 1 serving of a yellow or green leafy vegetable such as carrots, squash, broccoli, spinach, Swiss chard, Brussel sprouts, asparagus, string beans, or a legume as green peas or beans.	100%	
and		
(*c*) Cabbage, turnips or tomato (One salad scores as one vegetable.)		
3. Fruits.		
(*a*) Tomato juice—7 oz.		
or		
Grapefruit juice—4 oz.		
or		
Orange juice—3 oz.	100%	
and		
(*b*) Other fruits—One serving of other fruits scores 10%.		
Under certain circumstances an excess of the "a" group of fruits may make up for a deficiency of the "c" group of vegetables.		
4. Cereals.		
(*a*) 4 slices of whole grain bread		
and		
(*b*) 1 serving of whole grain cereal such as rolled wheat or rolled oats, or two additional slices of whole grain bread.	100%	
5. Meats.		
(1 serving averages 3 to 4 ounces.)		
(*a*) 1 serving of meat, or fish, or poultry		
and	100%	
(*b*) 1 serving of egg, or liver, or kidney, or tongue, or sweetbreads.		

The above foods will supply the essential food elements in the amounts required for good health, with the exception of sufficient calories. Although there are wide individual variations the average adult doing office work requires in the case of men 2,800 calories per day, and in the case of women 2,400. 1,900 calories per day are furnished by the above foods; additional calories may be obtained by increased amounts of these foods, or other foods not here listed.

and Group II, and at the same time a third group of teachers was asked to volunteer to supply information regarding diet, illness, absence and dental troubles. This was used as a control group. These teachers had received neither dietary advice nor vitamin pills.

It was hoped that approximately 500 teachers would enter each of the three groups, but at the end of the year it was found that the numbers had been reduced by resignations, changes in school, joining of the Armed Forces, and incomplete information (Table I).

Table II is based upon the analyses of the diets in terms of the main food groups as shown on the score sheet. If a diet showed one or more food groups below 50%, it was rated as "poor"; if one or more food groups scored below 75% but not below 50%, it was rated as "fair". If all food groups were above 75%, it was rated as "good". Whereas 38% of Group I had what were termed "poor" diets in their first record (May, 1941), only 5% had such a rating in May, 1942.

In Group I, 62% of the teachers improved their diets during the year, while 54% of Group II teachers improved their diets (Table III).

In Table IV the average daily consumption of each food nutrient is recorded for the three food records in each group. It will be noted that the average of 85 analyses of the first records of Group I showed 69.9 grm. of protein consumed per day. This was increased through dietary advice so that the average in May, 1942, was up to 74.9 grm. The average amount of calcium was increased from 0.81 to 0.95 grm. The average amount of iron was increased from 13.2 to 14.8 mgm. The amount of vitamin A was increased from 6,600 international units to 8,900 international units; vitamin B_1 from 405 to 498 international units; vitamin C was increased from 74.5 to 84.3 mgm., and vitamin B_2 from 1.69 to 2.06 mgm. per day. In Group II there was a slight improvement, but not so marked as in Group I. The average protein, calcium, vitamin A, vitamin B_1 and vitamin C showed some improvement.

Table IV does not, however, show the number who were below the minimum requirements. This is illustrated in Table V. It will be seen that the number taking less than the recommended amount of calcium was lower in the third records as compared with the first records, indicating an improvement in the diets of Group I. This is also true for the other food components. The improvement again was not nearly as striking in Group II (Table VI).

From the records of 355 teachers in Group I who completed the study it was found that 236, or 66.5%, were absent during the year previous to the commencement of the study, whereas 65.6% of Group II were absent during the same period (Table VII). In other words, the absence rate for the two groups in the year previous to the study was very similar. The average number of days absent for each teacher

TABLE I.
GENERAL INFORMATION

	Group 1 (Diet)	*Group 2 (Pills)*	*Group 3 (Controls)*
Number of teachers—volunteered	502	483	310
Number of teachers—completed study	360	387	293
Average age	41.3	40.0	39.2
Percentage of male teachers.	29.5	26.9	22.0

TABLE II.
PRELIMINARY RATING OF FOOD RECORDS

	Group 1 (Diet)			*Group 2 (Pills)*			*Group 3 (Controls)*
	1st record	*2nd record*	*3rd record*	*1st record*	*2nd record*	*3rd record*	*One record*
	%	%	%	%	%	%	%
Poor	38	18	5	55	34	18	30
Fair	38	28	22	27	31	29	35
Good	24	53	72	17	34	52	35

TABLE III.
CHANGE IN DIET SCORE

	Group 1 (Diet)	*Group 2 (Pills)*
Improved diets	62%	54%
Unchanged	36%	42%
Diets, worse	2%	4%

TABLE IV.
AVERAGE DAILY CONSUMPTION OF NUTRIENTS

	Group 1 (Diet)			*Group 2 (Pills)*		
	1st record	*2nd record*	*3rd record*	*1st record*	*2nd record*	*3rd record*
	(85)	(81)	(80)	(99)	(97)	(84)
Protein	69.92	74.22	74.97	67.8	74.2	70.9
Calories	2,275	2,410	2,381	2,221	2,376	2,352
Calcium	0.813	0.924	0.954	0.810	0.888	0.867
Iron	13.25	14.48	14.82	12.74	14.15	13.95
Vitamin A	6,626	8,477	8,960	5,992	7,550	8,822
Vitamin B_1	405	480	498	393	459	451
Vitamin C (raw)	74.5	74.4	84.3	78.3	74.8	83.5
Vitamin B_2	1.69	2.02	2.06	1.58	1.86	1.77

was 3.7 in Group I and 4.0 in Group II for that period.

As will be seen from Table VIII, during the twelve months of study, of 355 teachers in Group

TABLE V.

PERCENTAGE OF TEACHERS BELOW A MINIMUM DAILY INTAKE OF CERTAIN FOOD ELEMENTS GROUP I (DIET)

	1st record	*2nd record*	*3rd record*
Protein—below 60 grams	27.0	14.8	11.2
Calcium—below 0.8 grams	51.8	30.0	32.9
Iron—below 10 mgm	5.9	4.5	3.75
Vitamin A—below 5,000 units	42.5	12.3	21.5
Vitamin B_1—below 500 units	83.6	63.0	48.1
Vitamin C—below 50 mgm	22.1	23.7	2.5
Vitamin B_2—below 2.0 mgm	71.7	49.3	53.0

TABLE VI.

PERCENTAGE OF TEACHERS BELOW A MINIMUM DAILY INTAKE OF CERTAIN FOOD ELEMENTS GROUP II (PILLS)

	1st record	*2nd record*	*3rd record*
Protein—below 60 grams	27.0	14.8	11.2
Calcium—below 0.8 grams	56.0	40.2	45.2
Iron—below 10 mgm	15.0	5.8	4.7
Vitamin A—below 5,000 units	39.8	14.7	22.9
Vitamin B_1—below 500 units	87.8	64.6	66.3
Vitamin C—below 50 mgm	22.4	22.6	12.9
Vitamin B_2—below 2.0 mgm	77.4	60.8	69.1

TABLE VII.

RECORD OF ABSENCE DURING PREVIOUS YEAR

	Group 1 (Diet)	*Group 2 (Pills)*
Number of teachers reporting	355	372
Number of teachers absent	66.5%	65.6%
Total days absent	1,324.5	1,495.5
Days absent per teacher	3.73	4.02

TABLE VIII.

RECORD OF ABSENCE DURING YEAR OF OBSERVATION

	Group 1 (Diet)	*Group 2 (Pills)*	*Group 3 (Controls)*
Number of teachers reporting	355	379	293
Number of teachers absent	64%	67%	66.2%
Total days absent	1,188.5	1,483.5	1,096
Days absent per teacher	3.35	3.91	3.74

I, 64% were absent, while of 379 teachers in Group II, 67% were absent. The teachers in Group I were absent a total of 1,188.5 days, which was 136 days less than the previous year, whereas 379 teachers in Group II were absent 1,483.5 days, which is almost the same as during the previous year. The average number of days absent in Group I was 3.3, as compared with 3.7 the previous year, and compared with an average of 3.9 in Group II. The improvement in Group I, the improved-diet group, is slight and not very significant.

It is interesting to note that in Group III—teachers who took no part in this study until May, 1942, when they kept dietary records and reported illness and absence during the previous year, that is, the period corresponding with the year of observation for Groups I and II—66.2% of teachers were absent from school, the average number of days absent being 3.7 per teacher, which is slightly better than Group II, and not quite so good as Group I. Again, the difference is very slight.

Table IX shows that 356 teachers in Group I reported 497 colds, while 381 teachers in

TABLE IX.

INCIDENCE OF COLDS AND RELATED DISEASES

	Group 1 (Diet)	*Group 2 (Pills)*	*Group 3 (Controls)*
Number of teachers reporting	356	381	293
Number of teachers with colds	74%	78%	60%
Total number of colds	497	615	305
Number of colds per teacher	1.39	1.61	1.04

Group II reported 615 colds; that is, 74% in Group I and 78% in Group II. The records of those in Group III, the control teachers, showed only 60% with colds during the year. The average number of colds per teacher in Group I was 1.39, in Group II, 1.61, and in Group III, 1.04. It is felt that there is little if any significance to be attached to the difference in Group I and Group II. The difference in Group III might possibly be explained by the fact that the teachers in this group were trusting to memory for their record for the previous year, whereas Group I and Group II had been asked to keep an accurate record during the year.

Table X shows that 61.4% of the teachers in Group I had dental fillings during the 12 months previous to the study, compared with 64.6% of the teachers in Group II. The average number of fillings per teacher was 1.79 in Group I, and 1.77 in Group II. During the year of observation, only 49% of the Group I teachers had fillings, compared with 55.8% of Group II, and 62.4% of Group III (Table XI). This seems to be of some significance. It is further illustrated by the fact that the total number of

TABLE X.

DENTAL RECORD DURING 12 MONTHS BEFORE OBSERVATION

	Group 1 (Diet)	*Group 2 (Pills)*
Number of teachers reporting	322	328
Number of teachers had fillings	61.4%	64.6%
Total number of fillings	577	581
Number of fillings per teacher	1.79	1.78

TABLE XI.

DENTAL RECORD DURING 12 MONTHS OF OBSERVATION

	Group 1 (Diet)	*Group 2 (Pills)*	*Group 3 (Controls)*
Number of teachers reporting	322	328	280
Number of teachers had fillings	49%	55.8%	62.4%
Total number of fillings	423	450	476
Number of fillings per teacher	1.31	1.37	1.7

fillings in Group I was reduced from 577 in the year previous to study to 423 during the year of study. In Group II it was reduced from 581 to 450. It is interesting to note that Group III, the control group, in which there were a hundred fewer teachers than in the other two groups, required 476 fillings, which is more than either of the other groups. The average number of fillings per teacher was 1.31 in Group I, 1.37 in Group II, and 1.7 in Group III. This would suggest an improvement in the dental health of the teachers of both Groups I and II over the previous year, and also in comparison with Group III.

The interpretation of the meaning of the decrease in the number of new cavities in the teeth during the year of observation of those in Groups I and II is not easy. The possibilities are (1) that the records for the year of observation were more accurate because the teachers knew that they were to report; (2) that the teachers went to the dentist less because of war conditions and other pressure on their time, and (3) that the reduction represents accurately the situation, whether or not it was associated with nutritional improvement. The fact that the control group, Group III, is similar to the previous year of the other two groups suggests that reduced visits to the dentist were not an important factor, leaving us with the conclusion that the dental health of the teachers was slightly improved.

Table XII.—In the questionnaire which was sent to each teacher at the end of the year of study, the following question was asked, "Do you feel that your general health has improved, become worse, or remained the same during the past year?" In Group I, 40% felt that their health was better; in Group II, those taking pills, 61% thought that their general health was better.

TABLE XII.

STATE OF GENERAL HEALTH DURING PERIOD OF OBSERVATION (TEACHERS' OWN OPINION)

	Group 1 (Diet)	*Group 2 (Pills)*
Better	40%	61%
Same	56%	35%
Worse	4%	4%

DISCUSSION

The dietary habits and nutritional level of the Toronto school teachers are apparently sufficiently high that no marked improvement in the records of health could be shown by improvement of diet or by supplementing the diet with vitamin-mineral pills. The difference between the dietary level before and after advice was given, and in comparison with the dietary level of those who did not receive advice was not very great. No attempt was made to take into consideration the body build, age, sex or individual requirements or to adjust the standards in any way, so that it is probable that some teachers who received a low rating were taking a diet adequate for their needs but which did not meet the requirements laid down at the beginning of the study.

Whether the greater improvement in general health as reported by the group taking vitamin-mineral pills was real or due to psychological impressions, it was not borne out by the actual records of illness suffered.

It should be pointed out that this was a purely dietary survey and lacked any specific means of examination. The teachers were not medically examined or interviewed, and remained anonymous throughout. It is possible that had some of the newer methods of scientific examination and assessment of nutritional state been available, perhaps measurable changes could have been shown. Perhaps a longer period of preparation, say one year, of improving the dietary habits—before starting to take records of illness—would produce more striking results.

The food diaries compiled during the year of study have furnished valuable information which has been of national service.

SUMMARY

A dietary survey of a group of Toronto school teachers revealed a fairly high standard of food intake.

Some improvement in dietary habits was obtained in one group, as shown by analyses of weekly dietary records at three periods during the year by pointing out deficiencies to the individual.

No marked improvement was shown by the records of illness or absence from teaching duties, either as a result of improved diet or as a result of taking a vitamin-mineral preparation daily.

The number of new dental cavities was slightly reduced in the group with improved diets and in the group taking a vitamin-mineral preparation in comparison with their records for the year previous. The records of a group of control teachers showed a higher incidence of dental cavities.

A higher percentage of the teachers who received the vitamin-mineral preparation reported their general health to be improved.

We wish to acknowledge the assistance of Miss Dorothy G. Wiehl, Milbank Memorial Fund, New York, in planning this study and to thank her for her helpful suggestions and criticisms.

SOME OBSERVATIONS OF MOTION AT THE SHOULDER JOINT*

By Guy H. Fisk, M.D.

Montreal

A PERUSAL of the current textbooks and recent articles on the shoulder joint leaves the reader with a confused impression of the process involved in the normal movements of the shoulder. So much attention is given to the movement occurring at the scapulo-humeral joint that the reader gains the impression that the movements of the scapula, clavicle, and the sternum are of no importance. Martin,[1] for example, believes that the humerus is capable of rotating through 170 degrees at the scapulo-humeral joint. It is my purpose in this paper to show that practically 50% of the movement at the shoulder joint occurs as a result of the movements of the scapula and clavicle. The scapulo-humeral joint is thus responsible for only half the movement occurring at the shoulder. The movements of the bones forming the shoulder joint were elucidated by a study of the shoulder under a fluoroscope. X-ray films were taken in eight key positions to demonstrate all the points seen.

In order to be sure of the exact position of the humerus the elbow was flexed to a right angle, as this at once eliminated any errors in palpation of the condyles of the humerus. In order to check on the positions of the bones as seen in the x-ray films specimens of the humerus, scapula, and clavicle were examined under the fluoroscope until the exact position and configuration seen in the plates were reproduced. The subjects used for this project were three young, healthy women. Since the results checked to within five degrees, a description of the average results will be presented. The relationship of the bones in the eight key positions provides a complete picture of the movements possible at the shoulder joint.

Position 1 is the supine position of the anatomist; to the radiologist it is the position of external rotation. In this position the individual has the arm and forearm by the side, the hand faces forward, if the elbow is flexed to a right angle the fingers point directly anteriorly. The x-ray of this position is shown in Fig. 1. The humerus lies in external rotation, with the greater tuberosity forming its lateral border. The acromion process of the scapula is above and slightly behind the head of the humerus, while the anterior border of the glenoid cavity slightly overlaps the medial aspect of the humeral head. The medial angle of the scapula projects just above the medial half of the clavicle. The root of the spine of the scapula is horizontal and the vertebral border is vertical. The inferior angle of the scapula is level with and, in some cases, just behind the eighth rib. The clavicle is almost horizontal, while the top of the manubrium of the sternum is level with the upper half of the third thoracic vertebra.

Position 2 is that of full external rotation with the arm at the side. To attain this the forearm was bent at a right angle and the arm rotated externally as far as possible, with the elbow touching the chest wall. By measurement it was found that the arm rotated fifty degrees externally from position 1. The x-ray of this

* From the Physiotherapy Department of the Montreal General Hospital. This work was made possible by the grant from the Cooper Fund of the Faculty of Medicine of McGill University.