DIETARY STUDIES IN THE PUBLIC INSTITUTIONS OF ILLINOIS

(STUDIES IN THE HOSPITALS FOR THE INSANE)

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BY

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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(Studies in the Hospitals for the Insane).

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The feeding of the inmates of public institutions is one of the most important problems that the officers of such institutions have to deal with. It is by no means an easy or a simple matter to determine the diet which will be best adapted to the needs of those receiving it and which, at the same time, will be satisfactory from the standpoint of cost, to the communities supporting the institutions.

To a great extent, the results of the vast researches of the biological chemist on food and nutrition have been found of value in the dietetic management of public institutions. The feeding of the sick, invalid, and convalescent has been developed to a science in itself and constitutes an important branch of medicine. The rations of the armies and navies of most civilized countries are based upon the dietary standards of the biological chemist. The dietaries of many other public institutions have been regulated by them.

In general, the knowledge gained by the thorough and careful work of the scientist has been found beneficial wherever used. A wider use of it is desirable. It would insure the proper amount and kind of nourishment and result in a better condition of health and well being. Waste would be prevented to a great extent and resources would be conserved. Waste in large institutions is often considerable, and, when public institutions are concerned, it becomes a matter of some significance to the citizens supporting such institutions. Scientific management of the dietaries of public institutions

thus becomes a measure of pecuniary importance to the tax payer. It leads to economy in two ways: by preventing actual waste of food , and by bettering the conditions of the inmates; decreasing sickness and disease and the consequent cost of maintenance.

Aside from the economical and physiological benefits that such management assures, the progressive views of the present time decidedly favor that the unfortunates who make necessary the operation of public institutions, charitable, reformatory or penal, be accorded all the pleasures and comforts of life that their conditions permit.

In short, for economical, physiological and humanitarian reasons, the study of dietaries in public institutions is worthy of much more attention than it has thus far received. Professor Atwater has clearly and concisely stated the case. "The prisoner whom in justice we restrain and endeavor to reform, the sick, the poor whose lives we strive to make less unhappy, the orphan whom we desire to rear into useful citizenship, the tax payer whose burden we desire to relieve--in theinterest of all these such inquiries are called for."

THE WARDS OF THE STATE OF ILLINOIS.

The following statistics, taken from the Report of the Board of Public Charities, 1908,[1] demonstrate the responsible position that the care of the dependents and delinquents occupies among the functions of the state government.

On June 30, 1908, there were 17,921 inmates in the charitable, penal, and correctional institutions in the state of Illinois. These were classified as follows:

1. Insane; 9,985 or 56 per cent of the total.

2. Criminal class, including the inmates in the two prisons and in the reformatory; 3,684 or 21 per cent of the total.

3. The soldier wards (1404 old soldiers, 175 soldiers orphans, and 79 soldier widows); 1658 or about 9 per cent of the total.

4. The feeble minded; 1108 or 6 per cent of the total.

5. Juvenile dependent and delinquent; 792 or a little over 4 per cent of the total.

6. Deaf; 438 or about 3 per cent of the total.

7. Blind; 256 or 1.5 per cent of the total.

These figures refer to those in the state institutions. Besides these there were, in 1908, 3400 inmates in the county almshouses outside of Cook county. They were classified as follows:- insane, 365; idiotic and feeble minded, 416; deaf mutes, 33; blind, 107; epileptics, 98; consumptives, 47; children, 89; paupers, 2149. In the Cook county institutions there were 1935 insane, 101 idiotic and feeble minded, 2 deaf mutes, 31 blind, 31 epileptics, 303 consumptives, 46 children, and 1195 paupers; a total of 3644 dependents.

To these, too, must be added the varying populations of the county and city jails, the prisoners of which are, to a certain extent, supported by the communities.

Aside from these, the total number of inmates in the state and county institutions for 1908 was 24,965, 12,285 of whom were insane.

For the year ending June 30,1907, $640,141.86 was expended for food supplies for the seventeen state charitable institutions, viz., the institutions for the insane, the soldier wards, the feeble minded, the juvenile dependents and delinquents, the deaf, and the blind. For the year ending June 30,1908, this amount had increased to $710,840.25. Considerable food material, too, is produced on farms and gardens connected with the institutions.

These expenditures were for the food supplies for 14,237 of the 24,965 state and county charges enumerated above. The total cost of feeding the inmates of all the public institutions in the state is a matter that affects directly every tax payer in the state. Anything, therefore, that the scientific study of the food supplies of these institutions can do to bring about economy is worthy of consideration. Pecuniary economy, however, should not be the chief aim of such investigations. The welfare and well being of the unfortunate dependents should be placed first. When the interests of both tax payers and dependents are served at the same time,a condition that has always obtained in such work, the scientific dietectic management of the public institutions becomes most desirable.

In the statistics quoted above, it was seen that

about half the inmates of the public institutions in the state were classed as insane. For this reason and because the feeding of the insane presents a problem different in many respects from that found in the cases of other classes of dependents, this thesis will be confined to a study of the dietaries in public institutions for the insane.

The food requirements of the insane is a big subject in itself and one that has not received the attention that those of other public wards have.

HISTORICAL

Dietary Studies in Hospitals for the Insane.

Compared to the vast amount of work that has been done to determine the food consumption of healthy people, or even of the inmates of public institutions in general, but little has been done in institutions for the insane. The subject of dietary studies in such institutions has been reviewed briefly by Langworthy[2], Atwater[3,4], and Knight, Pratt, and Langworthy[5].

Some of the earlier European investigations are quoted and discussed by Meinert[6]. Meinert's decision was that the daily diet of the insane should conform with Voit's standard for men in health, and should contain 118 grams protein (100 grams of which should be digestible), 56 grams fat, and 500 grams carbohydrates.

In 1843, J. Pereira[7] published data regarding the kind and amount of food supplied at three hospitals for the insane. No dietary studies were made and the data given are not comparable to recent work.

More recent and extensive studies with the insane are reported by J. C. Dunlop[8]. In 1900, this investigator studied the food consumption in twenty-three asylums and in the lunatic wards of fourteen poor houses for the Commissioners in Lunacy for Scotland. The method employed was as follows: Blank schedules requesting detailed information regarding the quantities and character of the food supplied to various classes of patients and inmates and the average population for a period of one month, were sent to the heads of the different institutions. From the data returned on these schedules, verified "by correspondence in some cases and by visits to the institutions in others," the values of the different diets at the various asylums and poorhouse wards were calculated. The diets are judged primarily by their energy value. It is theinvestigator's opinion that the protein content should be equal to that of Voit's standards, 118 grams per day for men and 94 grams for women. The results obtained and the standards proposed are given in Tables I and 2. The report includes a general discussion of the proper diet for the insane.

The earliest work reported in this country is a description of the diet in the Boston Lunatic Asylum, reported by J.S. Gould in 1852[9]. Little more than the bill of fare is

given and it is of value chiefly from an historical standpoint.

Dr. Lee, in the American edition of Pereira's treatise[7], referred to above, gives similar information regarding the food supply at the Boston Lunatic Hospital and the Manhattanville (New York) Lunatic Asylum.

In 1895, J. D. Munson[10] published a brief account of dietary studies made at the Kankakee (Illinois) and Northern Michigan Asylums. The study at Kankakee was made by Miss S. E. Wentworth. In both studies the same method was used. The quantities of nutrients consumed per person per day ("physiological ration"), were calculated from the statistics of the food material issued, the average composition of the foods (assumed), and the average population, for one week. Ten per cent was deducted to allow for waste. The values obtained are included in Table 1.

In 1897, Mrs. Richards and Miss Wentworth[11] undertook a study of the food supplies of nine Boston institutions for charity and correction for the Institutions Commissioner of that city. Two of these institutions were hospitals for the insane. The results, given in Table 1, were obtained from statistics of the food supply and represent food supplied. Standard rations for the various institutions were suggested. That for hospitals for the insane is given in Table 2.

By far the most complete and thorough investigations of dietaries for hospitals for the insane were conducted by Atwater and his associates, in the New York State Hospitals

for the Insane, in the Connecticut State Hospital, and in the Government Hospital at Washington, D.C. The work in the New York hospitals was begun in 1897 at the request of the State Commissioners in Lunacy. The progress of the work is reported in the tenth[12], eleventh,[13] and twelfth[14] annual reports of the Commission. The thirteenth annual report[15] contains an account of the completed investigations. A general discussion of the studies is given in the Yearbook of the Department of Agriculture for 1901.[4]

Dietary Studies in the New York Hospitals. The primary object of these studies was to establish a dietary standard or standard ration for the New York State Hospitals for the Insane. Such standard was to be based upon the actual physiological need of the hospital population and was to allow a proper margin for shrinkage and waste of the food supply. In determining the standard, it was necessary to obtain information regarding the kinds, amounts, and actual nutritive value of the food material supplied; the amounts of food material actually eaten by different classes of the hospital population; and the losses of food by shrinkage and waste in the store room. Attempts were also made to improve the methods of cooking and serving the food in order to introduce variety and economy into the diet. Ways were sought by which more or less of the food material rejected in the dining room and kitchen and ordinarily wasted might be utilized. Finally, methods were devised by which the more expensive foods might at times be

replaced by the less expensive but equally nutritious and wholesome.

Dietary studies were made upon different classes of the hospital population. In making the classification the differences in physiological need, the division of patients actually recognized in the hospitals, and the fact that it is practical to prepare only a limited number of diets in the kitchens of such institutions were taken into account. On this basis the hospital population was separated as nearly completely as conditions would permit into four classes:-

1. The infirm, including the unproductive, inactive and unappreciative chronic patients.

2. The workers, including chronic patients engaged in productive employments and the more active of the restless and disturbed patients.

3. The acute, including the patients recently admitted and the sick.

4. The employees.

This classification is based primarily upon physical factors, physical work and activity and physical conditions in general.

In determining the quantities of food actually eaten by the different classes, the usual methods for conducting dietary studies were employed, modified to suit new conditions. The food sent to the dining room for one or more groups, and the food returned to the kitchen, were weighed. Thetable waste was

collected, separated into its components, and the weights of these determined. By difference, the quantities of food actually eaten were found. In general, the compositions of the cooked foods were calculated from the quantities and composition of the raw material from which they were made, and from the weights of the cooked food. The composition of the raw material was, in most cases, assumed from previous analyses of similar material.*

* Bulletin No. 28. Office Expt. Stat. U.S.D.A. The Chemical Composition Of American Food Materials. Atwater and Bryant.

The accuracy of these methods was tested by actual analyses and was further ascertained by making duplicate studies with the same groups, patients and employees, on the same diets at intervals of about one month. Such studies show small variations on the whole and are considered "mutually confirmatory, and lead to the belief that the figures for amounts of nutrients and energy in the food eaten per person per day are not far from correct."

In the beginning of the investigation, the quantities of the nutrients supplied to the different hospitals, per person per day, were calculated from the statistics of the food supplies purchased and the average populations of the hospitals. The values thus obtained and those found by actual dietary studies are all given in Table I.

Among other questions investigated were those of relative demands of men and women and of the influence of season on food consumption. In answer to the first, it was found that women ate 0.7 times as much as the men. This is a smaller

proportion than is found in the case of people in health. The difference is probably due to the fact that, in the hospitals, women do relatively less work than the men, because there is less opportunity to employ them. Regarding the influence of season, it was found that, in general, the tendency appeared to be toward a smaller food consumption in summer than in winter. Some exceptions to this condition are noted.

From the figures for food supplied to the hospitals in 1897-1898 and those for food eaten at the St. Lawrence Hospital in 1898-1899 (based on a limited number of dietary studies) the total waste, including shrinkage in the store-room and kitchen and dining room waste, was found to be nearly one third of the amount of the food supplied.

The conclusions arrived at are:-

1. Standards. The average daily food consumption per person at the St. Lawrence Hospital was 73 grams protein, 76 grams fat and 317 grams carbohydrates; fuel value 2305 calories.*

* These values for the entire hospital population were calculated from the results of the studies made at the hospital with a limited number of subjects and not with the entire population.

These values probably do not differ greatly from those obtaining in other hospitals. To set a perfectly safe standard, the physiological demands of the insane are considered to require 85 grams protein and 2500 calories energy per person per day. The ration allowance must contain an additional amount sufficient to cover losses due to shrinkage and waste.

2. The amounts of food supplied to the hospitals was greatly in excess of the actual needs of the populations for nourishment and of the amounts actually eaten.

3. Shrinkage and waste amount at least to one-fourth and possibly one-third of the food supplied. This amount can probably be reduced by more careful management and an application of the value of different foods. Improvement in this direction has already been accomplished.

4. More experimental work, especially metabolism experiments with a better classification of patients, is necessary before the exact physiological standard can be determined.

Studies in the Connecticut Hospital for the Insane. In 1899, while the work in the New York hospital was under way, Professor Atwater made two studies in the Connecticut Hospital for the Insane.[16] The Method used was practically identical with that used in the New York hospitals. The results, given per person per day, are included in Table 1. The conclusions were that the diets studied were ample in quantity, or even excessive.

Studies in the Government Hospital, Washington, D. C. The investigations at the Government Hospital for the Insane, made in 1902-03, under the auspices of the Office of Experiment Stations, United States Department of Agriculture, were reported by Pratt and Milner.[17] They are discussed by Atwater and

in the annual reports of the Office of Experiment Stations for 1903[18] and 1904[3]. Twenty-six studies are reported. Twenty-two of these are with patients (all males) and four with employees. The method used was practically identical with that employed by Atwater in the New York hospitals. The results (see Table 1) show, on the whole, a larger food consumption than was found in the New York and Connecticut institutions. This was probably to be expected, for the diets were somewhat better at the Government Hospital, and the patients were of a better class than those usually found in state institutions.

Dietary Studies in Baltimore: Knight, Pratt, and Langworthy report dietary studies in public institutions in Baltimore[5]. These were made in Old Peoples Homes, Orphan Asylums, and Bayview, the Baltimore Almshouse. In the latter, 625 of the 1348 inmates were insane and the studies there were chiefly with the insane patients. The composition of the food consumed was assumed from previous analyses of similar materials. The protein and energy values of the waste, however, were determined by analyses. The results (Table 1) are stated in terms of protein and energy only.

General Discussions:

General discussions of dietaries for hospitals for the insane may be found in articles by Pilgrim[19] and Richards[20], and in many of the references cited above: Atwater[3,4,15,18], Langworthy[2], Meinert[6], Munson[10] and Dunlop[8]. In addition to these, several of the text books on dietetics treat the subject more or less fully:- Gauter[21], Friedenwald and Ruhräh[22], Sutherland[23].

SUMMARY AND DISCUSSION.

The results of the dietary studies, briefly reviewed above, are tabulated in Table 1. Strictly speaking, they are not all comparable with each other or with those described later in this report. Practically all of the earlier results represent food supplies or ration allowances and these were determined from the statistics of the food supplies and average populations taken from the books of the institutions. They do not present any accurate data regarding actual food consumption and therefore, are hardly comparable with the results based on experimental dietary studies. In some cases, allowance for shrinkage and waste are made, but losses due to these causes can be determined accurately only by actual experiment.

The differences that the method of study makes in the results obtained is illustrated very well by the values obtained by Atwater. In the beginning of his work in the New York hospitals, he calculated the values of the food supplied per person per day in each of the state hospitals. Later, he conducted experimental dietary studies in several of the

TABLE 1. SUMMARY OF DIETARY STUDIES IN INSTITUTIONS FOR THE INSANE.

DESCRIPTION.	Investigator.	Reference No.	Nutrients. Protein. Grams.	Fat. Grams.	Carbohydrates. Grams.	Energy. Calories.	Remarks.
Scotch Almshouses for Pauper Lunatics,	Dunlop	8					
Excessive dietaries - males - average 11 studies,			149			3789	Probably ration allowance.
Dietaries approximating standards - males - average 13 studies,			136			3340	
Deficient dietaries - males - average 15 studies,			119			2998	
Excessive dietaries - females - average 25 studies,			119			3057	
Dietaries approximating standards - females - average 8 studies,			108			2695	
Deficient dietaries - females - average 6 studies,			95			2488	
Average male dietaries,						3335	
Average female dietaries,						2890	
Kankakee Asylum - per person per day,	Wentworth.	10	111	108	429		Total food supply less 10 per cent for waste.
Northern Michigan Asylum - per person per day,	Munson	10	114	112	460		
Boston Institutions:	Richards	11					
Austin Farm - Inmates and Employees,			110	114	449	3327	Calculated from food supply.
Pierce Farm - Inmates and Employees,			138	180	471	4171	
New York State Hospitals for the Insane,	Atwater	12					
Binghampton Hospital,			113	139	439	3555	Calculated from food supplies and average pupolations, 1897-98. Quantities per person per day. Total waste amounted to one-fourth to one-third but is not allowed for in figures given,
Buffalo "			110	142	414	3470	
Hudson River "			116	144	403	3470	
Long Island "			111	135	425	3455	
Manhattan "			121	141	517	3930	
Middletown "			106	130	342	3045	
Rochester "			108	132	379	3225	
St.Lawrence "			129	148	513	4010	
Utica "			109	131	398	3295	
Willard "			110	130	437	3450	
Average preceding ten,			113	137	427	3490	
Dietary studies - Long Island, Willard, and St.Lawrence Hospitals.	Atwater.	15					
Chronic patients, males, average 8 studies, infirm,			69	63	332	2230	Quantities per person per day in food actually eaten.
" " infirm, females, average 7 studies,			52	49	238	1645	

TABLE 1. (Cont.). SUMMARY OF DIETARY STUDIES IN INSTITUTIONS FOR INSANE.

DESCRIPTION.	Investigator.	Reference No.	Number of Subjects.	Nutrients. Protein. Grams.	Fat. Grams.	Carbohydrates. Grams.	Energy. Calories.	Remarks.
Light workers and disturbed, males, average 2 studies,	Atwater.	15		73	65	345	2318	
" " " females, " 4 "				56	53	243	1719	
Restless, active, disturbed, males, " 2 "				95	81	391	2746	
" " " females, " 4 "				58	59	278	1926	
Workers, males, " 10 "				103	91	404	2925	
" females, " 3 "				51	65	227	1744	
Acute, recent admissions, males, " 2 "				65	86	363	2555	
" " " females, " 2 "				35	54	175	1363	
Acute and sick chronic, males, " 2 "				66	80	364	2507	
" " " females, " 2 "				48	73	251	1905	
Connecticut Hospital for the Insane:	Atwater.	16						
Patients, quiet, demented (males, 184; females, 205) and Employees, (males, 13; females, 20).				84	84	377	2675	Quantities per person per day. In food actually eaten.
Patients, (males 268; females 285), and employees, (males 45; females, 52).				84	116	334	2790	
Government Hospital, Washington, D.C. Dietary studies with patients.	Pratt and Milner.	17						
Middle to old age, largely chronic, orderly and quiet, few workers, average 10 studies,			952	88	105	370	2767	All studies with male patients.
Acute, nervous, and disturbed, non-workers, average 3 studies,			94	84	97	350	2599	Quantities per man per day in food actually eaten.
Negroes, non-workers alone, (one study, values for			89	90	73	348	2402	
" workers alone, (subgroups estimated)			80	108	96	552	2694	
Sick, infirm, and bedridden, average 2 studies,			166	97	106	297	2519	
Some curable, part workers, younger and more active class, av. 2 studies,			59	104	125	347	2917	
Better class, on first section diet, average 2 studies,			22	125	149	393	3398	
Unclassified, average 2 studies,			127	76	86	385	2609	
Average of all patients,				90	102	359	2704	
Baltimore Institutions - Bayview almshouse,	Knight, Pratt and Langworthy.	5						
Regular inmates, males,			136	144			2901	In food actually eaten.
Chronic inmates, "			82	93			2076	

TABLE 1. (Cont.). SUMMARY OF DIETARY STUDIES IN INSTITUTIONS FOR INSANE.

DESCRIPTION.	Investigator.	Reference No.	Number of Subjects.	Nutrients. Protein. Grams.	Fat. Grams.	Carbohydrates. Grams.	Energy Calories.	
Receiving ward inmates, males,			82	111			2274	In food actually eaten.
Average 3 studies (males),				121			2504	
Women inmates, - per woman per day,			111	85			1924	
- per man per day basis,			111	106			2405	
Average 4 studies,			411	117			2453	

TABLE 2. DIETARY STANDARDS FOR INSANE INSTITUTIONS.

STANDARDS.	Proposed by	Reference No.	Nutrients. Protein. Grams.	Energy. Calories.	
The Insane, per person,	Richards.	11	110	3015	Ration allowance with 10 per cent margin for waste.
The Insane, per person,	Atwater.	15	85	2500	
" " per man,			100	2950	
The Insane, per man, average,	Dunlop.	8	118	3300	Probably ration allowance.
" " per woman, average,	"		94	2650	
" " male, working patients,	"			3500	
" " comparatively idle male patients,	"			3100	
" " female working patients,	"			2800	
" " comparatively idle female patients,	"			2500	

hospitals and, from the results, estimated the average consumption of nutrients and energy per person per day. The first results were about 33 1/3 per cent higher than the others. An inspection of Table 1 shows these differences at once.

Eliminating the less reliable data from further consideration, there are left the results reported by Atwater[12,15,16], Pratt and Milner[17] and Knight, Pratt and Langworthy.[5] These are based on accurate dietary studies and are comparable to the results of the best of the large number of dietary studies made in this country and abroad. They are extensive in themselves and represent the most accurate and complete information available concerning dietetics as related to hospitals for the insane.

But even these show considerable variations in the values for the different groups in any one institution as well as differences in the values for comparable groups in different institutions. The lowest values are probably among those found by Atwater in the New York hospitals. They vary from 35 grams protein and 1363 calories in the case of "Acute recent admissions, Females" to 103 grams protein and 2925 calories for the group "Workers, Males". The values for some of the other female groups are remarkably low, e.g., "Acute sick and chronic," 48 grams protein and 1905 calories; "Chronic patients, infirm," 52 grams protein, 1645 calories; and even the "workers", 51 grams protein, 1744 calories. In all cases, however, the investigator was satisfied that the diets were adequate.

In the Government Hospital at Washington, somewhat higher values were obtained. They vary from 76 grams protein

and 2609 calories for the "Unclassified" group to 125 grams protein and 3398 calories for the "Better Class" on "first section" diet, a much superior diet to those ordinarily found in institutions. The average of all patients studied was 90 grams protein and 2704 calories per man per day.

In the Bayview, Baltimore, Almshouse the average of three dietary studies with men was 121 grams protein and 2504 calories; the one study with women gave the values, 85 grams protein and 1924 calories.

It appears from these results that nothing very definite can be said concerning the food consumption of the insane, taken as a whole. Different groups or classes require different quantities of nutrients. The need of careful classification of the insane for dietetic purposes is evident. This fact has been strongly emphasized by Atwater.

Various dietary standards have been proposed. Some of these are given in Table 2. Those of Richards and Dunlop are ration standards. That of Atwater represents the "physiological demand". He considers 85 grams protein and 2500 calories per person per day or 100 grams protein and 2950 calories per man per day more than sufficient. This standard allows more protein and energy than was found to be consumed, on an average, in the studies in the New York and Washington hospitals, but contains less protein than the average consumed in the Baltimore Almshouse. Whether or not this standard is adequate is a fact which has not yet been proved. Much more work is needed before it can be accepted with any degree of finality. In

general, the standards have been based upon the assumption that the food requirements of the insane are governed by the same factors that those people in health thus are. This may be true but there is a possibility that there are other factors to be taken into consideration. At any rate, it is certain that there are many things besides the quantities of nutrients, protein, fat and carbohydrates, to consider in judging the value of the diet. Some of these are worthy of discussion.

Food is used for the production of energy for work (physical activity) and for body heat, and for the building and repair of tissues. For the production of energy, protein, fats, and carbohydrates are used. For the construction of tissues, protein alone suffices. Other constituents of food material are of great importance in the processes of nutrition, e.g., the mineral salts, organic acids, and extractives, but as they are present in relatively small proportions, or because their exact functions are not clearly understood, they are not usually considered in dietary studies. Under normal conditions of health and life, the quantities of food required depend primarily upon work (physical activity), sex, age, and size (body weight). Work (physical activity) appears to be the chief factor. The greater the physical activity the more energy in the form of carbohydrates and fats is required and the more protein is needed for rebuilding worn-out tissues. In regard to sex, it has been determined that ordinarily women eat about eight-tenths as much as men. Differences in amounts of work

done and in body weights or size probably account for this proportionately smaller consumption. In a general way, the amount of food eaten is proportional to the body weight (size). Age is an important factor. The aged and the young require less food than those in the prime of life. These are, in brief, the factors usually considered of greatest importance in judging diets and in setting dietary standards.

Recent work along other lines points to the necessity of extending the scope of dietary investigations and including work previously omitted or not sufficiently pursued. Not only should the proximate constituents of the diets be determined, but the character of these constituents should be given the most careful thought.

Not all the ingested food is capable of being digested and utilized by the body. In general, food of animal origin is more digestible than that derived from vegetable sources, and the proportion of a mixed diet actually utilized will depend upon the proportion of animal and vegetable foods that it contains. Of great interest in this connection is the work of Captain McCay on the Bengal Jail Dietaries.[24] The diets studied consisted entirely of vegetable material, and contained, in round numbers, 100 grams protein, 670 grams carbohydrates and 30 grams fat. Metabolism experiments on prisoners showed that only about 50 per cent of the protein was actually metabolized. On reducing the bulk of the diet by decreasing the amount of rice (and thereby decreasing the total nutrients of the diet), a better absoption was secured, not only relatively but absolutely. The addition of animal foods,

or rather, the substitution of animal foods for some of the vegetable material, in quantities very small compared to the amounts found in European and American diets, resulted in a better absorption, relatively and absolutely. At no time, however, was the absorption equivalent to that prevalent in Europe and America on the ordinary mixed diet.

The diet should be well balanced not only from the standpoint of total nutrients but also from that of animal and vegetable foods. This is important, too, in order to insure the proper quantities and proportions of the mineral substances. It has generally been assumed that mineral matter is present in sufficient and proper quantities in the ordinary mixed diet. This fact is probably true. But there is liable to be a deviation from this when the diet is not of the ordinary mixed variety, and the chances for such a thing happening are greater in institutions where a large number are fed and where the inmates have no choice in the selection of their food, than in smaller groups.

It is not the purpose of this paper to discuss in detail the functions of the mineral elements in nutrition but merely to suggest their importance and to emphasize the fact that they should be considered in dietary studies. Forbes of the Ohio Agricultural Experiment Station has recently published an able review of the literature of this subject and has demonstrated the importance of the mineral elements in animal nutrition[25], and the necessity of maintaining a proper balance

between inorganic acids and bases[26]. The mineral substances are used in the building of the tissues and are very essential to their construction. They are necessary to the processes of respiration; iron is the carrier of gaseous products. They maintain the proper acidity or alkalinity of the body fluids. They assist in the movement of the liquids and fluids in the body and through its tissues. Many vital reactions are stimulated or caused by them, e.g., the control of the muscles, coagulation of blood, solution and digestion of proteins and fats. Animal experiments have proved that without them life is impossible. Improper or insufficient quantities in thefood may lead to serious disturbances and diseases, such as acidosis and osteomalacia. Under normal conditions of diet and living there may be little danger of a lack of the mineral substances or a proper adjustment of the acid and alkaline elements. "But we do not always live under 'normal' conditions. We have set up standards for both man and his animals which differ greatly from those to which they have been adapted, and we use as foods and feeding stuffs a great variety of artificial products with which it is possible to tax the adaptability of the animal quite beyond the limits of toleration". (Forbes)

In this connection the possible relation of phosphorus to beriberi is of great interest. This disease has been found prevalent among oriental people who have lived upon a diet consisting chiefly of rice. The voluminous literature on this subject has been reviewed by Hans Aran[27]. His conclusions,

derived from a study of the literature and from metabolism and other experiments, are worth quoting verbatim.

"It is highly probable that living for an extended period on a one-sided almost exclusively vegetable diet, which is characterized by its poverty in phosphorus and protein may result in beriberi. The process of polishing rice removes a fine skin and the outer layers (bran). This rice bran is rich in phosphorus especially in its organic, soluble form (phytin,; the content of phosphorus of the rice is considerably reduced by the removal of the bran. Polished rice, poor in phosphorus, may cause beriberi in a man if it is the main constituent of the food, but it is harmless if sufficient other nourishment, rich in phosphorus and protein, is taken. The same polished rice causes a polyneuritis in chickens. White bread, a food of similar chemical composition as regards phosphorus and protein can not sustain monkeys in normal health if it forms the entire diet. The addition of phytin (the organic phosphorus compound from rice bran) considerably reduces the deleterious effect of white rice on chickens. Metabolism experiments show that a diet such as is described in this paper (chiefly vegetable) which contains 40 calories per kilo body weight and which supplies less than 0.2 grams nitrogen and 0.032 gram P_2O_5 per kilo body weight, can not meet the need of a normal man for phosphorus and protein. If phosphorus in the form of phytin or rice bran is added, a part is stored and a favorable influence on the nitrogen metabolism can also be observed. Metabolism experiments on a beriberi patient in

in a fairly advanced stage of the disease show that the capability of the man to utilize nitrogen and phosphorus in the food is reduced; he requires a higher intake of nitrogen and phosphorus than a normal person to attain nitrogen and phosphorus equilibrium. It is especially to be noted that the capability of utilizing additional doses of phytin is considerably less than is that of a normal person under like conditions. While it is certain and probable that phosphorus and nitrogen starvation cause a certain and probably great number of diseases which we term beriberi, there must be other factors, especially when the oedematous form is observed."

Phosphorus starvation appears to be a primary cause of beriberi, and the lack of phosphorus is brought about by the modern methods of preparing a staple food article, viz., the polishing of rice.

Just what the requirements of man are for the various mineral substances are facts at present practically unknown. Sherman and associates have studied the functions of iron[28] and of calcium, magnesium, and phosphorus[29] in nutrition. They have determined the proportions found in various foods, and have calculated the quantities in a number of typical American dietaries. Much more work, however, is needed in this direction.

The proper quantities and proportions of nutrients, including mineral elements, and the proper relation of animal and vegetable foods are qualities of the diet which can be

determined and regulated by the usual chemical studies. There are other properties ofthe diet which can not so be determined but which are of great importance especially in the case of diets in public institutions. Such are care in the preparation and serving of food and in preventing monotony.

It is obvious that only good food should be used and furthermore that it should be cooked in such a manner that it be palatable and readily digestible. If these precautions are not observed, there is a waste of valuable material. Further than this, it should be served in as attractive a manner as possible, and it is possible to do so without increasing materially the expense. The dining room should be clean and well ventilated. The table linen and dishes should be clean and nice appearing. There can be no doubt but that food served carefully is better relished than that served carelessly. Food that is relished stimulates the appetite, secures a better flow of digestive juices and insures a better degree of digestion. These are facts founded on physiological evidence. The work of Pawlow and followers need only be mentioned in this connection to show the value of psychical stimuli. It is one way in which mind influences metabolism. It has never been proved that the insane are not influenced by these psychical stimuli. They may be affected to a lesser extent; possibly there are some who have so far degenerated that their eating is much like that of lower animals; but there are few indeed who are not able to appreciate the comforts and pleasures of eating at least a

part of the time.

The number of attendants should be large enough to secure quick and good service of the food. Moreover, they should see that all get the proper amount. There are found among people in general many who exercise little control over the quantity and character of the food they eat. This condition holds for the insane to a greater degree. As a result, overeating, with its consequent evils and waste, results. On the other hand, there is danger in many cases of undereating, for there are many patients who, unless prompted and assisted, would not eat sufficient. Enough attendants should be present in the dining room to give each of those who need it individual attention.

One fault that is often found with institution diets which may be nearly perfect in other respects is that they lack variety. Monotonous diets are not relished and for that reason are not utilized as well as those possessing variety. There should be no great difficulty in securing this necessary quality. On the other hand, the food served should appear as nearly as possible familar to those receiving it, should be like that which they have been accustomed to, for novelty and strangeness may not be appreciated and may lead to under-eating.

The fore-going points are clearly and emphatically stated by many investigators, some of whom have had considerable experience with institution dietaries. For tne economic and humanitarian consideration of such diets, Atwater is especially good. Mrs. Richards has emphasized the importance of care in -

care in the preparation of food, chiefly from a practical standpoint. But of special interest are the statements of C.W. Pilgrim, the head of the state hospital for the insane. In his general discussion of hospital dietaries,[19] he warns against monotony of the diet. He regards the service of food as equally important as its kind and quality. He recommends that groups be small (not over 100) to insure proper attention. The desirability of having good china and table-ware instead of tin cups, pans and strange looking utensils, of using napkins and table-cloths, and even flowers, is emphasized.

Having a sufficient quantity of food, in a well balanced diet properly cooked and served, the question arises, Is this all that is necessary in devising a diet for the insane? Are the insane governed by the samefactors in their food consumption and demand as are people in health, or does insanity itself cause disturbances in metabolism which alter the consumption of and demand for food?

The concensus of opinion among those who have studied the nutrition of the insane is that they are governed by the same factor in these matters as are people in health, viz. physical activity, chiefly, and the standards proposed are based on this assumption. Atwater is inclined to think that the physiological demand of the insane for nourishment is on the whole smaller than that of normal people with corresponding physical activity. This is given, not as a fact tried and proved, but merely as a general observation based upon results obtained in the New York Hospitals. He has discussed the subject

at some length and hasendeavored to classify patients in his studies according to physical activity. This theory assumes that mind plays an inferior role in metabolism. The relation of mind to food consumption and metabolism is little known. It has been declared recently that the chief function of the brain is to regulate metabolism. No clear evidence of this fact is at hand, however. According to L. Mohr, in Van Noorden's "Metabolism and Practical Medicine"[33], much clinical evidence has been accumulated to show that nervous and mental diseases play an important part in many disorders of metabolism but the experimental data are of little value owing to difficulties of technique. In general, it is difficult to determine whether the disturbance of metabolism is due to the nervous disorder or whether the disorder is due to the disturbance. It has been shown that mental activity itself probably does not influence metabolism, or if it does, changes caused by it are too small to be measured. What are needed in this very important problem are thorough and complete metabolism experiments. Such work would no doubt be exceeding difficult, considering the character of the subjects, but until it is done no clear idea of the food requirements of tne insane can be had.

There is one class of insane who, all authorities agree, need special care in diet as well as in other matters. This class includes the acute, or recent admissions, for for whom there is much hope for recovery. They require all the care that can possibly be given and such food as may be

deemed necessary by the physician in charge. For them, special diets are necessary and they should be classified with the sick and invalid.

DIETARY STUDIES AT THE PEORIA STATE HOSPITAL.

In the summer of 1910, information was sought concerning the food supply and consumption at the Peoria State Hospital. The investigations made consisted of two dietary studies and such general observations as possible.

The Peoria State Hospital.

The Peoria State Hospital is located on a hill or plateau overlooking the Illinois Valley at South Bartonville, Illinois, about five miles south of Peoria. At the time of the investigation it had a population of 2100 to 2200 patients. The cottage plan of housing the inmates is used. The population is divided among a number of buildings, called cottages, each accomodating from 50 to 150 people. The first and second floors are used for living and sleeping quarters and the basements for dining room. The grounds are spacious and well cared for, although a great part of them has been allowed to keep its natural beauty. The patients at this hospital differ somewhat from those found at other institutions. The hospitals was established in 1902 as the Asylum for the Incurable Insane and was intended to receive the incurable and hopelessly insane from the other institutions and from county almshouses.

Up to a few years ago this was the class chiefly sent to this asylum. Acute cases have been received during the past few years. On the whole the population consists of the hopeless, untidy, and incurable insane," the worst insane in the state." In another respect this institution differs from other insane asylums. The policy of non-restraint is in force practically throughout the entire institution. There are no bars on the windows, no fences around the grounds, and the patients are allowed to roam around at will. This is important to remember, since it permits the patients to secure considerably more exercise than would otherwise be possible, and the greater degree of physical activity influences the food consumption. In general, a great deal of the work of the institution is performed by the inmates. The care of the cottages, work in the kitchen and laundry, on the farm and inthe garden, is distributed among a large number, however, and may not give much work to any one patient, except in certain cases.

The food for the entire institution is cooked in one kitchen and taken from there in metal boxes and cans on wagons and carts to the various dining rooms in the cottages. The kitchen is characterized by the remarkable degree of cleanliness which is maintained at all times in spite of the amount of work andthe confusion attending the preparation of food for over 2000 people three times a day. From a mechanical standpoint, the equipment of the kitchen and attached bakery is nearly perfect. The work was supervised by a chief cook

and five paid assistants who had the help of about thirty patients.

The Dietary Studies.

Primarily, the investigations sought two things: first, to determine as accurately as means would permit, the nutritive value ofthe food supply at the hospital; and second, to determine the nutritive values of two special diets, the Corn and Corn-free diets, which had been in use at the institution for about one year.

In order to determine with absolute accuracy the food consumption of the entire population of the hospital, it would have been necessary to conduct a large number of dietary studies. Time and means would not permit this. As an alternative it was decided to select a group of patients of convenient size which would be as representative as possible of the entire body in respect to the amount of food eaten, the amount of work done, and their physical and mental conditions.

At the time of the studies there were six diets in use at the institution. They were as follows:

1. General diet-furnished to the greater part of the population.

2. Special Diet- for the hospital and infirmary patients.

3. Tent Colony Diet-for consumptive patients inhabiting the tent colony wards.

4. and 5. Corn and Corn-free Diets. These will be explained later.

TABLE 3. SPECIMEN DIETS. SEPTEMBER 9, 1910.

Breakfast.	Dinner.	Supper.
General Diet.		
Boiled rice.	Steamed potatoes.	Peach tapioca.
Steamed potatoes.	Creamed onions.	Bread.
Bread.	Bread.	Butterine.
Butterine.	Butterine.	Tea.
Syrup.	Vegetable soup.	
Coffee.	Crackers.	
Special Diet.		
Boiled rice.	Creamed potatoes.	
Bread.	Prune pudding.	Bread.
Butterine.	Bread.	Butterine.
Syrup.	Butterine.	Peach tapioca.
Toast.	Vegetable soup.	Tea.
Coffee.	Crackers.	Milk.
Milk.	Milk.	
Bed patients and convalescents get milk or egg-nog at 10 a.m. and 3 p.m.		
Tent Colonies.		
Boiled rice.	Creamed potatoes.	Bread.
Bread.	Prune pudding.	Spice pudding.
Butterine.	Bread.	Butterine.
Syrup.	Butterine.	Peach tapioca.
Coffee.	Vegetable soup.	Tea.
Toast.	Crackers.	
Milk.	Milk.	
Bed patients and convalescents get milk or egg-nog at 10 a.m. and 3 p.m.		
Employee's Diet.		
Fried potatoes.	Creamed potatoes.	Creamed potatoes.
French toast.	Scalloped corn.	Scalloped corn.
Corn flakes.	Cabbage salad.	Cabbage salad.
Rhubard sauce.	Sliced tomatoes.	Sliced tomatoes.
Bread.	Bread.	Bread.
Butterine.	Butterine.	Butterine.
Coffee.	Pumpkin pie.	Pumpkin pie.
	Cheese.	Cheese.
	Coffee.	Coffee.
	Salmon.	Salmon.

6. Employees Diet.

To illustrate the difference in these, specimen diets, taken from the hospital diet sheet for September 9, 1910 are given. (Table 3.)

In a way, the general diet is the basis ofthe others. With the exception of the Employee's diet, the others are special diets given to comparatively few patients. By far the greater number of inmates received the General diet and, for this reason, it was selected for the first study.

Dietary Study Number 1. General Diet.

There were several groups which appeared to fill the required conditions. Two of them, consisting of 200 to 250 patients each, were too large to work with. The third was a colony of about 53 men. Fifty of these were epileptics, two were dements, and one was an idiot. Mentally, their conditions varied from fair intelligence to extreme stupidity. Physically, they ranged from a young and fairly strong boy of about 19 years to feeble old men. A number of them did some work taking care of their cottage and dining room. Most of them took more or less excercise walking around the grounds. None probably did any very hard work. From appearances, this group seemed to be fairly representative of the entire patient population of the institution, and the amount of food they consumed was probably very close to the average for all the patients, especially for those on the General diet.

The Diet For The Week.

The menus for the week are given on the following pages. (Table 4). They are arranged parallel to those for the Corn and Corn-free diets which were investigated later. As explained in the foot note, no butterine was served on the first day because the supply had run out. At one meal, however, cheese were substituted for the butterine. Just previous to the beginning of the study, the baker of the institution met with an accident which incapacitated him. Another baker was secured to take his place, but he was unable to turn out the necessary work and confined his efforts chiefly to keep up the supply of bread. On this account there was missing from the General diet the usual cake and pastry goods as follows:-

Wednesday, September 7--Coffee cake.

Thursday, September 8--Biscuits.

Friday, September 9--Cookies.

Saturday, September 10--Ginger bread.

Monday, September 12--Biscuits.

Tuesday, September 13--Cookies.

Since these would have added to the appearance of the diet and, possibly, influenced the amount of food consumed, these facts are noted.

On the other hand, milk appears twice during the week in the diet studied, though it is not a regular constituent of the General diet. When any was left over

TABLE 4. MENUS.

GENERAL DIET.

Breakfast.	Dinner.	Supper.
	Thursday, Sept. 8.	
Oatmeal.	Boiled cabbage	Green beans
White bread	Beef stew	and potatoes
1	White bread	White bread
Coffee	Butterine	Butterine
Steamed	Coffee	Tea
potatoes		
	Friday, Sept. 9.	
Boiled rice	Vegetable soup	Peach tapioca
Steamed	Crackers	White bread
potatoes	Steamed	Butterine
White bread	potatoes	Tea
Butterine	Creamed onions	
Coffee	White bread	
	Butterine	
	Saturday, Sept. 10.	
Corn meal mush	Sausage	Rhubarb sauce
Milk	Navy beans	Macaroni and cheese
Steamed potatoes	Beet pickles	White bread
White bread	White bread	Butterine
Butterine	Butterine	Tea
Coffee	Coffee	
	Sunday, Sept. 11.	
Boiled rice	Boiled cabbage	Stewed prunes
Milk	Green beans	White bread
White bread	Peach pie	Butterine
Butterine	White bread	Tea
Coffee	Butterine	
	Coffee	

CORN DIET.

Breakfast.	Dinner.	Supper.
	Thursday, Sept. 29.	
Hominy	Beef stew	Stewed tomatoes
Milk	Cabbage	Cheese
White bread	Canned corn	Tapioca pudding
Butterine	Tomatoes	Corn bread
Coffee	White bread	Butterine
	Butterine	Tea
	Coffee	Milk
	Friday, Sept. 30.	
Corn flakes	Beef soup	Stewed prunes
Milk	Crackers	Corn starch pudding
Beef stew	Creamed	Milk
White bread	potatoes	White bread
Butterine	String beans	Butterine
Coffee	Corn bread	Ive cookies
	Butterine	Tea
	Saturday, Oct. 1.	
Oat meal	Sausage	Stewed tomatoes
Milk	Navy beans	Corn starch pudding
Corn bread	Bread pudding	White bread
Butterine	Corn bread	Butterine
Coffee	Butterine	Ginger bread
	Coffee	Tea
	Sunday, Oct. 2.	
Corn meal mush	Boiled cabbage	Lima beans
Frankforters	Mashed potatoes	Corn bread
White bread	Whole tomatoes	Butterine
Butterine	Corn bread	Rice pudding
Coffee	Butterine	Milk
	Squash pie	Tea
	Coffee	

CORN-FREE DIET.

Breakfast.	Dinner.	Supper.
	Thursday, Sept. 29.	
Boiled rice	Beef stew	Stewed tomatoes
Hot milk	Cabbage	Cheese
Toast	Macaroni and	Tapioca pudding
White bread	cheese	White bread
Butterine	Tomatoes	Raised rolls
Coffee	White bread	Butterine
	Butterine	Tea
	Coffee	Milk
	Friday, Sept. 30.	
Farina	Beef soup	Stewed prunes
Milk	Crackers	Spiced pudding
Beef stew	Creamed	Milk
White bread	potatoes	White bread
Butterine	String beans	Butterine
Coffee	White bread	Ive cookies
	Butterine	Tea
	Saturday, Oct. 1.	
Oat meal	Sausage	Stewed tomatoes
Milk	Navy beans	Chocolate pudding
White bread	Bread pudding	White bread
Butterine	White bread	Butterine
Coffee	Butterine	Ginger bread
	Coffee	Tea
	Sunday, Oct. 2.	
Farina	Boiled cabbage	Lima beans
Frankforters	Boiled beef	White bread
White bread	Whole tomatoes	Butterine
Butterine	White bread	Rice pudding
Toast	Butterine	Milk
Coffee	Squash pie	Tea
	Coffee	

TABLE 4. (continued). MENUS.

GENERAL DIET.			CORN DIET.			CORN-FREE DIET.		
Breakfast.	Dinner.	Supper.	Breakfast.	Dinner.	Supper.	Breakfast	Dinner.	Supper.
	Monday, Sept.12.			Monday, Oct. 3.			Monday, Oct. 3.	
Corn meal mush	Beef stew	String beans	Corn flakes	Steamed potatoes	Macaroni and tomatoes	Oat meal	Steamed potatoes	Macaroni and tomatoes
Steamed potatoes	Lentils	and potatoes	Milk	Lentils	Scalloped corn	Milk	Lentils	Tapioca pudding
White bread	Onions	White bread	Beef stew	Corn bread	White bread	Beef stew	White bread	White bread
Butterine	White bread	Butterine	White bread	Butterine	Biscuits	Butterine	Butterine	Biscuits
Coffee	Butterine	Tea	Butterine	Toast in custard	Butterine	Coffee	Toast in custard	Butterine
	Coffee		Coffee	Coffee	Tea		Coffee	Tea
	Tuesday, Sept. 13.			Tuesday, Oct. 4.			Tuesday, Oct.4.	
Boiled rice	Vegetable soup	Cheese	Oat meal	Beef soup	Corn fritters	Oat meal	Beef soup	Boiled rice
Stewed prunes	Crackers	Hominy	Milk	Crackers	White bread	Milk	Crackers	White bread
White bread	Steamed potatoes	White bread	Corn bread	Baked potatoes	Butterine	White bread	Baked potatoes	Butterine
Butterine	Navy beans	Butterine	Butterine	Stewed corn	Cocoanut pudding	Butterine	Stewed tomatoes	Cocoanut pudding
Coffee	White bread	Tea	Coffee	White bread	Ive cookies	Coffee	White bread	Ive cookies
	Butterine			Butterine	Tea		Butterine	Tea
	Wednesday, Sept. 7.			Wednesday, Oct. 5.			Wednesday, Oct. 5.	
Boiled rice	Beef stew	Hominy	Hominy	Boiled cabbage	Stewed prunes	Farina	Boiled cabbage	Stewed prunes
Steamed potatoes	Lima beans	White bread	Toast	Boiled potatoes	White bread	Toast	Boiled potatoes	Baked tomatoes
White bread [1]	Sliced Cucumbers	Cheese[1]	Hot milk	Whole tomatoes	Butterine	Hot milk	Whole tomatoes	White bread
Coffee	White bread [1]	Tea	Boiled beef	Corn bread	Corn starch pudding	Boiled beef	White bread	Butterine
	Coffee		White bread	Butterine	Coffee cake	White bread	Butterine	Coffee cake
			Butterine	Coffee	Tea	Butterine	Coffee	Tea
			Coffee			Coffee		

In addition, each of the groups received 6 pounds of sugar per week. Syrup was supplied ad libitum, practically, a large can of it being kept in the dining room.

1. On Wednesday, September 7th, and Thursday, September 8th (breakfast), no butterine was given because the supply had run out. On Wednesday, September 7th, at supper, cheese was substituted for butterine. See also description of the diet regarding pastry goods.

from its other uses, it was sent to the group experimented upon.

Plan of the Experiment.

The method used in this experiment was to determine accurately the quantities of food actually eaten by the group under observation, to take representative samples of the materials eaten and analyse them chemically, and, from the data thus obtained, to calculate the quantities of nutrients, energy, etc., actually consumed.

The system employed at the hospital for distributing the food made the work of weighing and of selecting the samples comparatively simple. A complete set of boxes and containers, such as were regularly used for carrying the food from the kitchen to the dining room, was secured, numbered and reserved for the experiment. Each box or container was weighed before being used. The food for the experimental cottage was placed in these weighed receptacles. At the same time, a second portion (duplicate), consisting of about half the amount of the first, was selected and set aside to be used for the sample. Care was taken to have both portions alike. The food for the patients was weighed, taken to the cottage, and served in the usual manner. After the meal was finished, all untouched food was put back in the boxes or containers in which it came, all "leavings" were carefully collected and placed in an empty weighed can, and then both were returned to the kitchen and weighed. The amount of food used--the difference between

the amount sent and the amount returned, not including the "leavings", and not the amount of food actually eaten-- was determined and, from the duplicate portion, an aliquot part was weighed out for the sample.*

* Salt, pepper, vinegar, and syrup were regularly kept in the dining room. It was necessary to weigh these only at the beginning and close of the experiment, or when the supply became exhausted, as in the case of syrup, and take samples proportionate to the amounts used during the periods between the weighings.

Composite samples were made of similar food materials as follows:-

A. Animal foods--included meats and cheese.

B. Vegetable foods--included potatoes, legumes, other vegetables, fruits, sugar, vinegar.

C. Mixed foods:-included substances containing appreciable quantities of both animal and vegetable materials, such as vegetable soup and macaroni and cheese.

D. Bread and crackers.

E. Coffee and tea.

F. Milk.

G. Butterine.

H. Syrup.

I. Waste food. The entire quantity of waste food (or "leavings") was taken for the sample.

J. Salt.

Data regarding the composite samples, the quantities

of foods used, and the proportions taken in making the composite samples, are tabulated on the following pages. (Table 5.)

The samples were placed in ten-gallon milk cans, or smaller receptacles for butterine, salt and syrup, which had been sterilized by rinsing with an alcoholic solution of thymol, and kept in a cold storage room at low temperature (about 38^{0} F). Small quantities of thymol and formaldehyde were used as preservatives.

The experiment began with breakfast on Wednesday, September 7th. and continued through supper on Tuesday, September 13th., lasting one whole week.

After the samples were all in, coffee and tea, milk, and butterine, respectively, were sampled at once by thoroughly mixing and taking a two quart jar full of each. The samples of syrup and salt were small and needed no further sampling. The remaining samples, contained in nine ten-gallon milk cans, were shipped to the laboratory by express. Immediately after arriving there, they were ground in a meat cutter and thoroughly mixed, in preparation for the analytical work.

Methods of Analyses.

Moisture, protein, fat, ash, and phosphorus were determined in the fresh samples. Carbohydrates were calculated by difference from the other values.

Protein was obtained by multiplying the total nitrogen value by the factor 6.25. Total nitrogen was determined by the Kjeldahl-Sherman method.

TABLE 5. DESCRIPTION OF COMPOSITE SAMPLES AND QUANTITIES OF FOOD USED IN DIETARY STUDY NO.1. GENERAL DIET.

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20039	Animal Foods.	Sept.7	Dinner	Beef stew	14.07	One-fourth amount used taken for sample.
		" 7	Supper	Cheese	3.29	
		Sept.8	Dinner	Beef stew	15.43	
		Sept.10	"	Sausage	6.48	
		" 12	"	Beef stew	15.73	
		" 13	Supper	Cheese	3.53	
				Total	58.53	
20040	Vegetable Foods.	Sept.7	Breakfast	Boiled rice	12.51	one-fourth of amount used taken for sample.
		" 7	"	Steamed potatoes	6.15	
		" 7	Dinner	Lima beans	12.15	
		" 7	"	Sliced cucumbers	5.94	
		" 7	Supper	Hominy	14.76	
		Sept.8	Breakfast	Steamed potatoes	7.23	
		" 8	"	Oatmeal	14.70	
		" 8	"	Sugar	1.05	
		" 8	Dinner	Boiled cabbage	14.39	
		" 8	Supper	Green Beans and Potatoes	22.47	
		Sept.9	Breakfast	Boiled rice	14.56	
		" 9	"	Steamed potatoes	7.78	
		" 9	Dinner	" "	11.70	
		" 9	Supper	Sugar	1.22	
		Sept.10	Breakfast	Corn meal mush	15.21	
		" 10	"	Steamed potatoes	6.86	
		" 10	Dinner	Navy beans	16.86	
		" 10	"	Beet pickles	7.77	
		" 10	Supper	Rhubarb sauce,	13.33	
		Sept.11	Breakfast	Boiled rice	24.07	
		" 11	"	Sugar	0.55	
		" 11	Dinner	Boiled cabbage	7.99	
		" 11	"	Green beans	15.90	
		" 11	Supper	Stewed prunes	18.98	
		Sept.12	Breakfast	Corn meal mush	11.51	
		" 12	"	Steamed potatoes	8.16	
		" 12	Dinner	Lentils	5.21	
		" 12	"	Onions	3.08	
		" 12	Supper	String beans and potatoes	14.74	
		Sept.13	Breakfast	Boiled rice	14.52	
		" 13	"	Stewed prunes	2.24	
		" 13	Dinner	Steamed potatoes	7.17	
		" 13	"	Navy beans	14.75	
		" 13	Supper	Hominy	18.68	
		Sept.7-Sept.13	------	Vinegar,	0.62	
				Total	374.81	

TABLE 5. (continued).

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20041	Bread	Sept.7	Breakfast	White bread	6.25	One-eighth of amount used taken for sample.
		"	Dinner	" "	7.25	
		"	Supper	" "	5.71	
		Sept.8	Breakfast	" "	5.75	
		"	Dinner	" "	6.37	
		"	Supper	" "	6.14	
		Sept.9	Breakfast	" "	5.75	
		"	Dinner	" "	5.32	
		"	"	Crackers	2.04	
		"	Supper	White bread	6.14	
		Sept.10	Breakfast	" "	6.65	
		"	Dinner	" "	5.65	
		"	Supper	" "	6.20	
		Sept.11	Breakfast	" "	6.10	
		"	Dinner	" "	6.32	
		"	Supper	" "	6.09	
		Sept.12	Breakfast	" "	5.49	
		"	Dinner	" "	6.74	
		"	Supper	" "	7.36	
		Sept.13	Breakfast	" "	7.06	
		"	Dinner	" "	5.14	
		"	"	Crackers	1.52	
		"	Supper	White bread	7.13	
				Total	134.17	
20042	Mixed Foods.	Sept.9	Dinner	Creamed onions	10.30	One-fourth of amount used taken for sample.
		"	"	Vegetable soup	18.47	
		"	Supper	Peach tapioca	21.19	
		Sept.10	"	Macaroni and cheese	4.03	
		Sept.11	Dinner	Peach pie	7.88	
		Sept.13	"	Vegetable soup	15.44	
				Total	77.31	
20044	Milk	Sept.10	Breakfast	Milk	11.84	One-fourth of amount used taken for sample.
		" 11	"	"	12.23	
				Total	24.07	

TABLE 5. (continued).

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20043	Coffee and Tea.	Sept.7	Breakfast	Coffee	16.88	One-eighth of amount used taken for sample.
		"	Dinner	"	16.56	
		"	Supper	Tea	15.19	
		Sept.8	Breakfast	Coffee	16.28	
		"	Dinner	"	12.86	
		"	Supper	Tea	13.02	
		Sept.9	Breakfast	Coffee	18.35	
		"	Supper	Tea	15.27	
		Sept.10	Breakfast	Coffee	16.11	
		"	Dinner	"	16.80	
		"	Supper	Tea	13.24	
		Sept.11	Breakfast	Coffee	15.05	
		"	Dinner	"	14.90	
		"	Supper	Tea	12.94	
		Sept.12	Breakfast	Coffee	18.18	
		"	Dinner	"	14.25	
		"	Supper	Tea	13.50	
		Sept.13	Breakfast	Coffee	18.95	
		"	Supper	Tea	16.03	
				Total	294.36	
20045	Butterine	Sept.8	Dinner	Butterine	0.64	One-fourth of amount used taken for sample.
		"	Supper	"	0.69	
		Sept.9	Breakfast	"	0.83	
		"	Dinner	"	0.74	
		"	Supper	"	0.71	
		Sept.10	Breakfast	"	0.78	
		"	Dinner	"	0.73	
		"	Supper	"	0.77	
		Sept.11	Breakfast	"	0.72	
		"	Dinner	"	0.81	
		"	Supper	"	0.74	
		Sept.12	Breakfast	"	0.81	
		"	Dinner	"	0.68	
		"	Supper	"	0.67	
		Sept.13	Breakfast	"	0.72	
		"	Dinner	"	0.67	
		"	Supper	"	0.77	
				Total	12.48	

TABLE 5. (Concluded.)

Lab. No	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20047	Syrup	Sept. 7-10		Syrup	13.78	1/25 th.
		" 10-13		"	12.66	of amount
				Total	26.44	used taken for sample.
					Amount. Kilos.	
20048	Waste Food.	Sept.7	Breakfast		2.47	Total amount taken for sample.
		"	Dinner		4.30	
		"	Supper		1.83	
		Sept.8	Breakfast		3.58	
		"	Dinner		4.61	
		"	Supper		4.30	
		Sept.9	Breakfast		3.04	
		"	Dinner		1.16	
		"	Supper		3.06	
		Sept.10	Breakfast		5.80	
				Total	34.15	
20049	Waste Food.	Sept.10	Dinner		1.07	Total amount taken for sample.
		"	Supper		1.57	
		Sept.11	Breakfast		1.80	
		"	Dinner		3.50	
		"	Supper		1.15	
		Sept.12	Breakfast		3.00	
		"	Dinner		1.52	
		"	Supper		0.83	
		Sept.13	Breakfast		0.76	
		"	Dinner		1.95	
		"	Supper		2.56	
				Total	19.71	
20050	Salt	Sept.9-Sept.13			0.65	

Moisture was found by drying about 5-10 grams ofthe material in vacuo over sulphuric acid to constant weight.

Fat was determined by extracting the dried material from the moisture determination with anhydrous ether for 72 hours in a Soxhlet apparatus, and weighing the extract thus obtained.

In estimating the percentage of ash or mineral matter, a suitable sample,12-20 grams, was dried and charred at low heat. The charred mass was extracted with water. The insoluble residue was dried and burned in a muffle to remove all organic matter. The water extract was then added to the burned residue, evaporated to dryness, and the combined mass was ignited at a low red heat until the ash was gray or white. It was heated to constant weight.

The difference between the total dry substance and the sum of protein, fat, and ash was taken for the carbohydrate value.

Phosphorus was determined in the residue from the ash determination. The ash was treated with concentrated nitric acid on the water bath, and the mixture was diluted and filtered. The phosphorus was first precipitated with acid ammonium molybdate solution. This precipitate was dissolved in ammonia and the phosphorus reprecipitated as magnesium ammonium phosphate. It was weighed as the pyrophosphate.

All determinations were made in triplicate, and except where the difference was very great, the average of all three values was taken.

The fuel value of the diet was calculated by multiplying the number of grams of protein and carbohydrates by 4, and the number of grams of fat by 8.9, these factors representing the available fuel values of the nutrients per gram total nutrients according to Atwater.

Food Consumption.

The percentage composition of the various samples and the total quantities of nutrients contained in the food used, wasted and actually eaten are summarized in Table 7. The quantities consumed per man per day were found by dividing the total quantities consumed by the average daily population of the cottage multiplied by seven. The average daily population varied somewhat from day to day on account of transfers to and from other wards. The number of subjects composing the group, who received their meals only in the dining room where the experiment was carried on, is shown in the following table:

Table 6. Number of Subjects. Dietary Study No.1

Date	Breakfast	Dinner	Supper	Average
Wednesday, Sept. 7	54	54	53	53 2/3
Thursday, Sept. 8	53	53	52	52 2/3
Friday, Sept. 9	53	53	53	53
Saturday, Sept. 10	53	53	53	53
Sunday, Sept. 11	53	53	53	53
Monday, Sept. 12	53	53	53	53
Tuesday, Sept. 13	53	53	53	53
			Average for Week	53 1/21

The average quantities of nutrients actually consumed per man per day were found to be: protein, 73.51 grams;

TABLE 7. SUMMARY. DIETARY STUDY NO.1. GENERAL DIET.

Laboratory No.	Food Material.	Weight of Food Used.	Protein.		Carbohydrates.		Fat (Ether extract).		Fuel Value.	Ash. (Mineral matter).		Phosphorus.	
			Per cent.	Quantity.	Per cent.	Quantity.	Per cent.	Quantity.		Per cent.	Quantity.	Per cent.	Quantity.
		Kilos.		Grams.		Grams.		Grams.	Calories.		Grams.		Grams.
20039	Animal Foods	58.53	13.99	8188.35	3.59	2101.23	12.33	7216.75		2.12	1240.84	0.162	94.82
20040	Vegetable Foods	374.81	1.87	7008.95	16.26	60944.11	0.37	1386.80		1.09	4085.43	0.041	153.67
20041	Bread	134.17	8.49	11391.03	57.40	77013.58	0.63	845.27		1.19	1596.62	0.095	127.46
20042	Mixed Foods	77.31	1.96	1515.28	15.11	11681.54	1.42	1097.80		0.97	749.91	0.036	27.83
20043	Coffee and Tea	294.36	0.04	117.74	0.99	2914.16	0.03	88.31		0.06	176.62	-----	------
20044	Milk	24.07	3.12	750.98	4.96	1193.87	2.36	616.19		0.74	178.12	0.094	22.63
20045	Butterine	12.48	0.44	54.91	----	--------	88.21	11008.61		3.30	411.84	0.014	1.75
20047	Syrup	26.44	0.16	42.30	76.17	20139.35	0.07	18.51		1.25	330.50	0.007	1.85
20050	Salt	0.65	----	-----	-----	--------	----	-----		99.75	648.37	------	------
Total in Food Used				29069.54		175987.84		22278.24			9418.25		430.01
20048	Waste Food	34.15	3.18	1085.97	19.62	6700.23	2.73	932.30		1.37	467.86	0.064	21.86
20049	Waste Food	19.71	3.48	685.91	21.77	4290.87	3.24	638.60		1.64	323.24	0.047	9.26
Total in Waste Food				1771.88		10991.10		1570.90			791.10		31.12
Amount actually consumed[1]				27297.66		164996.74		20707.34			8627.15		398.89
Average - per man per day				73.51		444.34		55.77	2568		23.23		1.07
Average - per kilo body weight[2]				1.10		6.62		0.83	38.3		0.35		0.016

[1] Net amount for seven days, 53 1-21 subjects.
[2] Average weight of subjects, 67.1 kilos.

carbohydrates, 444.34 grams; fat, 55.77 grams; ash(mineral matter), 23.23 grams; phosphorus, 1.07 grams. The total fuel value of the diet is 2568 calories.

Intake per Kilo Body Weight.

The subjects of this group were not weighed during the time of the experiment. They are, however, weighed twice a month by the attendants in charge of the cottage. The weights thus obtained were secured and averaged with the following results. The average weight of the group on September 1st., was 148.0 pounds or 67.3 kilos; on September 15 th., 147.2 pounds or 66.9 kilos. It is probably safe to assume that the mean of these two values, 67.1 kilos, is not far from the average weight of the group during the time of the experiment, September 7th. to 13th. Accepting it as the average weight of the group, the intake of the various nutrients per kilo body weight per day is found to be: protein, 1.10 grams; carbohydrates, 6.62 grams; fat, 0.83 grams; energy,38.3 calories; ash, 0.346 grams; phosphorus, 0.016 grams.

Discussion of Results.

Atwater has set the standard of 100 grams protein and 2950 calories per man per per day for insane hospitals. The values found in this study are considerably lower than Atwater's standard. This standard, however, was based on a food consumption (calculated) of 73 grams protein and

and 2305 calories per person per day, quantities which would be equivalent, about, to 86 grams protein and 2700 calories per man per day. These figures are for the entire hospital population including employees. Compared to the results obtained with certain individual groups of patients in Atwater's work, the the values found in this study assume a different position. A class of patients in the New York hospitals, to which the group receiving the General diet might be compared fairly, is the one described as"light workers and disturbed." This class consumed 73 grams protein and 2318 calories per man per day, practically the same quantity of protein and 200 calories energy per man per day less than was eaten by the patients on the General diet. In the Connecticut hospitals, the values obtained, 84 grams protein and 2675 calories and 84 grams protein and 2790 calories are somewhat larger than those reported here, but the studies there included employees and it is safe to assume that the patients received less, on the average, than the quantities reported. The average of the studies with the patients at the Government Hospital at Washington was 90 grams protein and 2704 calories per man per day. The fact that the diets in this institution are better than those usually found in public institutions of this kind, would account for a higher consumption. At the Baltimore Almshouse, the average of three studies with men was 121 grams protein and 2504 calories per day, a very much higher protein content than found in the diet here reported.

It is difficult to make fair comparisons of the results

obtained in the investigations described in this paper. Differences in the classification of patients, in the character of the diets, and in the methods used, account, in part, for the lack of uniformity of the results. On the whole the diet here studied contains less nutrients than the others and is low especially in protein.

Dietary standards for adults in health to which, on thebasis of physical activity, the values obtained with the general diet might be compared, are represented by the following taken from Atwater's series.

	Per man per day. Protein(grams)	Energy(Cal.)
Man with moderately active muscular work.....	125	3400
Man with light-moderate muscular work.....	112	3050
Man with sedentary work.....	100	2700
Man with very little exercise.....	90	2450

Compared to these, 73.5 grams protein and 2568 calories, the the values here reported, appear deficient.

That the large quantities of protein and energy called for by the dietary standards are necessary, is a question that has received considerable discussion quite recently. Many investigators have been able to maintain nitrogen equilibrium on quantities of protein much smaller that the standard requirements and with varying amounts of energy producing nutrients. The work of these investigators has been compiled and discussed by Magnus-Levy[30]. In many of the experiments, a low protein intake was accompanied by a high energy value of the diet. Most of the experiments were conducted for short periods "and do not quite

correspond to the conditions of daily life." Foremost among the low protein advocates is Chittenden[31]. His work is not open to the criticisms of the others for his diets were normal with regard to the energy content and his experiments extended over long periods and were conducted with a large number of different classes with respect to occupation and physical and mental activity. Chittenden's conclusions were that "a daily metabolism of proteid matter equal to an exchange of 0.10-0.12 gram of nitrogen per kilogram of body weight is quite adequate for physiological needs, provided a sufficient amount of non-nitrogenous foods- fat and carbohydrates- is taken to meet the energy requirements of the body." In terms of protein, this amounts to 0.62 to 0.75 grams per kilo body weight. The required intake of protein is placed at 0.85 gram, and of energy at 40 calories per kilo body weight for the average man. On this basis the general diet contains an excess of protein, supplying 1.10 grams per kilo body weight.

Regarding low protein diet, Magnus-Levy says:- "It will be willingly granted by all that a greater simplicity of diet, and a reduction of the protein intake may be of the greatest benefit, especially in thecase of individuals who are in the habit of eating too much. In the case of those suffering from illness, the liver, the kidneys, and perhaps, above all, the nervous system, may be injuriously affected by such a diet."

In the nutrition experiments carried on at the University

of Illinois in 1906 and 1907, with men in normal health, under the direction of Dr. Grindley,[34] results were obtained which are intermediary between the high and low standards discussed above. The average consumption of nutrients and energy of twenty-one men for a period of 220 consecutive days, on a normal diet and under normal conditions of living, was as follows:- protein, 83.63 grams; fat, 130.9 grams; carbohydrates, 368 grams; energy, 3079 calories. Per kilo body weight 1.25 grams protein and 46.2 calories energy were ingested per day. These quantities were amply sufficient to maintain a positive nitrogen balance and, practically, constant body weight. In other words they were entirely adequate to the needs of the men. Compared to these values, the quantities ingested by thepatients on the General diet under discussion are deficient, both in protein and energy.

In many of the dietary studies reviewed, the fact that the subjects left food which they might have eaten has been taken as an indication that the food they did eat was sufficient for their requirements. In this study there was left uneaten food (waste food) containing, per man per day, 4.77 grams protein, 29.6 grams carbohydrates, and 4.23 grams fat, equivalent to 175 calories energy. It might appear from this that the quantities actually eaten were entirely adequate. On the other hand, the food consumption is influenced by other factors than the amount supplied. The character of the food exerts a decided influence both on thetotal quantity eaten and on the relative amounts of nutrients ingested.

That a diet on a higher plane will cause a greater ingestion of nutrients, is shown by the results of the second dietary study at the Peoria State Hospital, where the Corn-diet was used.

The need of more knowledge regarding the dietetic requirements of the insane has been pointed out above. Until more is known regarding them, it is difficult to say whether the food eaten in this study was adequate to the demands of the subjects. On the whole, it probably was. It must be remembered, however, that the values obtained represent the average consumption of a considerable number of men. How many of these received more and how many received less than the figures indicate it is impossible to say. If any received much less than the average amounts, it would seem likely that they were receiving too little. For the protection of such, it seems best to insist upon a generous supply for the entire group.

Not all the food that is ingested is digested and utilized by the body. Animal foods are, as a rule, more digestible than vegetable foods. On the ordinary mixed diet, it is generally considered that 92 % of the protein and 91 % of the energy, are capable of being utilized by the organism. McCay[24] found that only 50 % of the protein was metabolized on a purely vegetable diet. Other conditions influence the digestion and utilization of the ingested nutrients, e.g., the care with which the food has been prepared, the degree of mastication, and certain pathological conditions, including,

possibly, insanity or certain forms of it. Just what proportion of the diet studied in this investigation was available could be determined only by actual metabolism experiments. It would be of interest, however, to determine the source of the various nutrients.

Distribution of Nutrients.

Such information is summarized in Table 8. Here the distribution of the various nutrients among the different foods and classes of foods, is given quantitatively and proportionally. It will be noticed that the percentages are based on total food used and not on the amount actually consumed. It was impossible to separate the waste food into its components and, therefore, the source of the nutrients of the waste and also of the food actually consumed cannot be definitely determined. It is very probable, however, that the differences in the composition of the waste compared to the total food used is not sufficient to alter the values obtained very much, and that the percentage figures represent the character of the diet quantitatively.

The foods are classified according to their origin, i.e. vegetable or animal. Such classification is not absolute, however, for the samples were taken from the cooked foods which contained material derived from both sources. Total Animal Foods include milk and the foods designated animal foods(meat

TABLE 8. DISTRIBUTION OF NUTRIENTS. DIETARY STUDY NO.1. GENERAL DIET.

Laboratory No.	Food material.	Fresh Food. Quantity.	Per cent of total.	Per man per day.	Dry Substance. Quantity.	Per cent of total.	Per man per day.	Protein. Quantity.	Per cent of total.	Per man per day.	Carbohydrates. Quantity	Per cent of total.	Per man per day.
		Kilos.		Grams.	Kilos.		Grams.	Grams.		Grams.	Grams.		Grams.
20039	Animal Foods	58.53	5.84		18.75	7.92		8188.35	28.17		2101.23	1.19	
20044	Milk	24.07	2.40		2.74	1.16		750.98	2.58		1193.87	0.68	
Total	Animal Foods	82.60	8.24	222.44	21.49	9.08	57.86	8939.33	30.75	24.07	3295.10	1.87	8.87
20040	Vegetable Foods	374.81	37.38		73.42	31.03		7008.95	24.11		60944.11	34.63	
20041	Bread	134.17	13.38		90.85	38.39		11391.03	39.19		77013.58	43.76	
20043	Coffee and Tea	294.36	29.35		3.30	1.39		117.74	0.40		2914.16	1.66	
20047	Syrup	26.44	2.64		20.53	8.68		42.30	0.15		20139.35	11.44	
Total	Vegetable Foods	829.78	82.75	2234.61	188.10	79.49	506.56	18560.02	63.85	49.98	161011.20	91.49	433.61
20042	Mixed Foods	77.31	7.71		15.04	6.36		1515.28	5.21		11681.54	6.64	
20045	Butterine	12.48	1.24		11.34	4.79		54.91	0.19		--------	----	
Total	Mixed Foods	89.79	8.95	241.81	26.38	11.15	71.06	1570.19	5.40	4.23	11681.54	6.64	31.46
20050	Salt	0.65	0.06	1.75	0.65	0.27	1.75	-------	----	----	--------	----	-----
Total	Food Used	1002.82	100.00	2700.62	236.62	100.00	637.22	29069.54	100.00	78.28	175987.84	100.00	473.94
20048	Waste Food												
20049	" "	53.86	5.37	145.05	15.12	6.39	40.73	1771.88	6.10	4.77	10991.10	6.25	29.60
Amount actually consumed		948.96	94.63	2555.57	221.50	93.61	596.49	27297.66	93.90	73.51	164996.74	93.75	444.34

TABLE 8. (Cont.). DISTRIBUTION OF NUTRIENTS. DIETARY STUDY NO.1. GENERAL DIET.

Laboratory No.	Kind of Material.	Fat. Quantity.	Fat. Per cent of total.	Fat. Per man per day.	Fuel Value. Per cent of total.	Fuel Value. Per man per day.	Ash. Quantity.	Ash. Per cent of total.	Ash. Per man per day.	Phosphorus. Quantity.	Phosphorus. Per cent of total.	Phosphorus. Per man per day.
		Grams.		Grams.		Calories.	Grams.		Grams.	Grams.		Grams.
20039	Animal Foods	7216.75	32.39				1240.84	13.17		94.82	22.05	0.26
20044	Milk	616.19	2.77				178.12	1.89		22.63	5.26	0.06
Total	Animal Foods	7832.94	35.16	21.09	11.63	319	1418.96	15.06	3.82	117.45	27.31	0.32
20040	Vegetable Foods	1386.80	6.22				4085.43	43.37		153.67	35.74	0.41
20041	Bread	845.27	3.79				1596.62	16.95		127.46	29.64	0.34
20043	Coffee and Tea	88.31	0.40				176.62	1.87		------	-----	----
20047	Syrup	18.51	0.08				330.50	3.51		1.85	0.43	0.01
Total	Vegetable Foods	2338.89	10.49	6.30	72.58	1991	6189.17	65.71	16.67	282.98	65.81	0.76
20042	Mixed Foods	1097.80	4.93				749.91	7.96		27.83	6.47	0.07
20045	Butterine	11008.61	49.41				411.84	4.37		1.75	0.41	0.01
Total	Mixed Foods	12106.41	54.34	32.60	15.79	433	1161.75	12.33	3.13	29.58	6.88	0.08
20050	Salt	--------	-----	-----			648.37	6.88	1.75	-----	----	----
Total	Food Used	22278.24	100.00	60.00	100.00	2743	9418.25	100.00	25.36	430.01	100.00	1.16
20048-49	Waste Food	1570.90	7.05	4.23	6.38	175	791.10	8.40	2.13	31.12	7.24	0.08
Amount actually consumed		20707.34	92.95	55.77	93.62	2568	8627.15	91.60	23.23	398.89	92.76	1.07

and cheese). Total Vegetable Foods include syrup, coffee and tea, bread and the miscellaneousfoods primarily of vegetable origin. Total Mixed Foods include butterine* and other substances which contained appreciable amounts of both animal and vegetable material. Table salt occupies a separate position in the table.

*The butterine used was an oleomargerine which contained cotton seed oil.

Total Food Used: The total vegetable food furnished 82.75 per cent of the total food used; the total animal foods, 8.24 per cent; the total mixed foods, 8.95 per cent; and salt 0.06 per cent.

Dry Substance: On a dry basis, these figures are changed slightly. 79.49 per cent of the dry substance is derived from the total vegetable foods; 9.08 per cent from the total animal foods; 11.15 per cent from total mixed food; and 0.27 per cent from salt.

Protein is distributed as follows:- Total vegetable foods, 63.85 per cent; total animal foods, 30.75 per cent; total mixed foods, 5.40 per cent. The importance of animal foods as a source of protein in concentrated form becomes apparent by comparing the proportion of total dry substance (or total protein to the proportion of food) that they furnish.

Bread supplies more protein than any other food material: 39.19 per cent of the total quantity.

The animal foods (meat and cheese) furnishes 28.17 per cent and vegetable foods 24.11 per cent.

Coffee and tea and syrup are represented as supplying small quantities, 0.4 and 0.15 per cent of the total, respectively. The protein values were obtained by multiplying the total nitrogen content by the factor 6.25. All the nitrogen of the tea and coffee and syrup, as well as of practically all other foods, does not come from protein material. However, the error intoduced in this way is very small, and since it is not usually taken into consideration in dietary studies, no attempt has been made to correct it here.

Carbohydrates. Very nearly all the carbohydrates of this diet are derived from vegetable foods. The total vegetable food supply 91.49 per cent of the total carbohydrates; the total animal foods, 1.87 per cent; and the total mixed foods, 6.64 per cent. Of the proportion attributed to total animal foods, 0.68 per cent is furnished by the milk and 1.19 per cent by the meat and cheese. A small part of this latter amount probably comes from the cheese. The larger part, however, represents the carbohydrates added to meat (beef stew) in the form of flour to make the gravy. It should be added to the carbohydrates of the total vegetable foods. Undoubtedly, too, the larger part of the carbohydrates in the mixed foods is of vegetable origin.

Bread alone supplied 43.76 per cent of the total carbohydrates.

The 1.66 per cent credited to the coffee and tea probably represents the sugar added to these in the preparation.

Fat: Only 10.49 per cent of the total fat is derived from the total vegetable food. Total animal food furnishes 35.16 per cent and the total mixed foods, 54.34 per cent. Butterine, classed with the mixed foods, is the chief source of fat, supplying nearly half (49.41 per cent) of the total amount. The values for fat represent the crude fat or ether extract and are probably greater than they should be. The small quantities of ether extract from coffee and tea and from syrup are included with fat, although, for the greater part, probably other substances.

Fuel Value. On a diet consisting so largely of vegetable foods, it might be expected that the greater part of the energy would be derived from that class. This is the case with the diet studied. The total vegetable foods yield 72.58 per cent of the total energy; the total animal foods, 11.63 per cent; and the total mixed food, 15.79 per cent.

Ash (Mineral Matter). About two-thirds (65.71 per cent) of the total mineral matter in the diet, comes from the total vegetable foods; 15.06 per cent from the total animal foods; 12.33 per cent from the total mixed foods; and 6.88 per cent from the salt.

Distribution of Different Food Materials and Nutrients in the Average Americam Diet.

In connection with the dietary studies made under the auspices of the United States Department of Agriculture, the data from about 400 dietary studies have been summarized and arranged to show "the proportionate amounts of different foods which make up the diet of the average American home and the relative proportions of the total nutrients and energy which the principal foods and food groups supply". The data in the following table are abstracted from this information given by Langworthy[32].

Table 9. Proportion of Nutrients Furnished by Different Food Materials in the Average American Diet.

Food Material		Total Food Material P.Ct.	Protein P.Ct.	Fat. P.Ct.	Carbo-hydrates. P.Ct.
Animal Foods:	Total Meats	16.0	29.7	58.8	---
	Fish	1.8	3.5	1.0	---
	Eggs	2.1	4.1	2.9	---
	Total Dairy Products	18.4	10.0	25.7	3.6
	Unclassified Animal Foods	0.2	0.2	0.2	0.3
	Total Animal Foods	38.5	47.5	88.6	3.9
Vegetable Foods:	Total cereals	30.6	43.0	9.1	61.8
	Sugar, molasses, etc.	5.4	----	---	17.6
	Legumes, tubers, and other vegetables	20.3	8.7	1.0	12.0
	Fruits (including nuts)	4.4	0.5	0.5	3.7
	Unclass. Veg. Foods	0.5	0.1	0.2	0.6
	Total Vegetable Foods	61.2	52.3	10.8	95.7
Misc. Food Material		0.3	0.2	0.6	0.4
Total Food Material		100.0	100.0	100.0	100.0

Comparing these values with similar ones for the diet studied in this investigation, the vegetable nature of the latter is apparent. In the average American dietary, the total animal foods constitute 38.5 per cent and the total vegetable foods 61.2 per cent of the total food used. In this diet, only 8.24 per cent of the total food consists of animal foods and 82.75 per cent of vegetable foods. It might be expected that a diet containing such a large proportion of vegetable foods would be less digestible than the average American diet. On the other hand, since the total energy of the diet, 2568 calories per man per day, is not excessive, the result of the low proportion of animal foods may simply be to decrease the nutritive value of the diet, and primarily, the protein content. In the absence of data regarding the digestibility and availability of such a diet as this, it would be best to accept the second view and to conclude, not that there is an excess of vegetable foods, but that there is possibly a deficiency in animal foods.

An increase of animal foods to a level approaching that of the average American diet would increase the protein content, chiefly, and also the energy value. An increase in the fuel value would not be objectionable. A larger quantity of protein would be desirable. In the average American dietary, the animal foods supplied 47.5 per cent and the vegetable foods 52.3 per cent of th total protein. In the nutrition investigations conducted recently at the University of Illinois, and referred to above[34], 61.0 per cent of the total ingested

protein was derived from animal foods. This was the average value for the entire experiment (21 men, 220 days). The coefficient of digestibility of protein for th entire experiment was 90.55 per cent. In the diet here reported, only 30.75 per cent of the total protein was derived from animal foods and 79.49 per cent from vegetable foods.

If an increase in animal foods were made, the added nutrient need not necessarily be meats, although this diet does not contain an excessive amount of such foods. Milk, dairy products, and eggs are excellent food materials. The cost might be an objection to their use, but it is certain that they might be added to the diet, in small quantities at least, to great advantage.

DIETARY STUDY. S NUMBER 2. CORN DIET.

Two groups of patients at the institution received special diets known as the Corn and Corn-free diets. The Corn-free diet, as the name indicates, contained no corn products or corn foods of any kind. The Corn diet on the other hand, contained a considerable quantity of foods derived from corn, such as corn bread, corn meal mush, puddings and custards made from corn starch, etc.. The purpose of feeding these diets was to determine the relation of corn and corn products to pellagra. At the time of this study, the groups had received these diets for about one year.

The primary object of the studies on these diets

was to determine their nutritive value. Since they were both on a somewhat higher plane of nutrition than the General diet, any information regarding their utilization, compared to that of the General diet, must necessarily be of interest and value.

It was planned to conduct studies on both diets simultaneously, but this plan was found to be impracticable and the study on the Corn-diet alone was completed.

The Diets.

The menus for the week of the study for both Corn and Corn-free diets are arranged parallel to those for the General diet for the week it was studied, in Table 4. It will be noticed at once that the Corn and Corn-free diets were much superior to the General diet.

The Patients.

The following description is taken from the report of Dr. Rachel A. Watkins, the physician in charge of the two groups during the year that they were receiving special diets. The patients were selected from the "medium of the demented untidy class, ranging in age from 21 - 79 years, with an average of 45 years. Most of them showed more or less marked dementia and fairly good physical conditions, making fair average of the demented asylum inmate".

The fifty-six patients receiving the corn diet were weighed by the attendants on October 6th. The weights ranged

from 106 to 206 pounds. The average for the group was 138 pounds, or 62.7 kilos.

Plan of the Experiment.

This experiment was conducted in practically the same manner as the first. A separate sample was made of the foods containing corn products of any kind. Otherwise the samples were composited as in Study No. 1. The data regarding the weights of food used, composite samples, and proportions of foods used taken for samples, are tabulated on the following pages. (Table 10.) The study was begun with breakfast on Thursday, September 29th. and, continuing for seven days, ended with supper on Wednesday, October 5th.

The number of men composing this group remained constant during the week and was fifty-six.

Coffee and tea, milk, butterine, syrup, and salt were sampled at the hospital as before. The remainder of the material, contained in eleven ten-gallon milk cans, was shipped to the laboratory and treated as the samples in the first study.

The same determinations were made as in the previous investigations. The results are summarized in Table 11.

Food Consumption.

The average quantities of the various nutrients consumed by the group receiving the Corn diet were, per man per day: protein, 87.22 grams; carbohydrates, 462.37 grams; and fat

TABLE 10. DESCRIPTION OF COMPOSITE SAMPLES AND QUANTITIES OF FOOD USED IN DIETARY STUDY NO.2. CORN DIET.

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20051	Animal Foods.	Sept.29	Dinner	Beef stew	14.75	One-
		"	Supper	Cheese	3.36	fourth
		Sept.30	Breakfast	Beef stew	14.34	of
		Oct. 1	Dinner	Sausage	7.40	amount
		Oct.2	Breakfast	Frankforters	4.11	used
		Oct. 3	"	Beef stew	14.01	taken
		Oct. 5	"	Boiled beef	15.59	for
						sample.
				Total	73.56	
20056	Milk	Sept.29	Breakfast	Milk	7.85	One-
		"	Supper	"	7.06	eighth
		Sept.30	Breakfast	"	12.63	of
		"	Supper	"	10.15	amount
		Oct.1	Breakfast	"	10.93	used
		Oct.2	Supper	"	7.22	taken
		Oct.3	Breakfast	"	11.84	for
		Oct.4	"	"	12.82	sample.
		Oct.5	"	Hot "	8.57	
				Total	89.07	
20052	Vege- tables.	Sept.29	Dinner	Cabbage	16.87	One-
		"	"	Whole tomatoes	11.72	eighth
		"	Supper	Stewed tomatoes	15.14	of
		Sept.30	Dinner	Creamed potatoes	10.92	amount
		"	"	String beans	8.12	used
		"	Supper	Stewed prunes	10.16	taken
		Oct.1	Breakfast	Oat meal	10.41	for
		"	Dinner	Navy beans	13.55	sample.
		"	Supper	Stewed tomatoes	14.06	
		Oct.2	Dinner	Boiled cabbage	16.42	
		"	"	Mashed potatoes	9.61	
		"	"	Whole tomatoes	10.38	
		"	Supper	Lima beans	10.49	
		Oct.3	Dinner	Steamed potatoes	9.04	
		"	"	Lentils	11.13	
		"	Supper	Macaroni and tomatoes	13.87	
		Oct.4	Breakfast	Oatmeal	13.62	
		"	Dinner	Baked potatoes	8.20	
		Oct.5	"	Boiled cabbage	16.62	
		"	"	Boiled potatoes	16.51	
		"	"	Whole tomatoes	10.52	
		"	Supper	Stewed prunes	8.24	
		Sept.29-Oct.5		Vinegar	0.79	
		" " " "		Sugar	2.02	
					268.41	

TABLE 10. (continued).

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20054	Mixed Foods.	Sept.30	Dinner	Beef soup	18.98	One-
		Oct.1	"	Bread pudding	9.97	eighth
		Oct.2	"	Squash pie	4.62	of
		"	Supper	Rice pudding	17.01	amount
		Oct.4	Dinner	Beef soup	20.46	used
		Sept.29	Supper	Tapioca	15.04	taken for
				Total	86.08	sample.
20058	Corn Foods.	Sept.29	Breakfast	Hominy	15.87	One-
		"	Dinner	Canned corn	10.15	eighth
		"	Supper	Corn bread	15.31	of
		Sept.30	Breakfast	Corn flakes	1.66	amount
		"	Dinner	Corn bread	13.50	used
		"	Supper	Corn starch pudding	14.63	taken
		Oct.1	Breakfast	Corn bread	19.90	for
		"	Dinner	" "	12.61	sample.
		"	Supper	Corn starch pudding	10.87	
		Oct.2	Breakfast	Corn meal mush	12.92	
		"	Dinner	Corn bread	15.07	
		"	Supper	" "	13.79	
		Oct.3	Breakfast	Corn flakes	1.59	
		"	Dinner	Corn bread	13.98	
		"	"	Toast in custard	8.18	
		"	Supper	Scalloped corn	12.40	
		Oct.4	Breakfast	Corn bread	13.40	
		"	Dinner	Stewed corn	13.81	
		"	Supper	Corn fritters	6.85	
		"	"	Cocoanut pudding	12.38	
		Oct.5	Breakfast	Hominy	17.55	
		"	Dinner	Corn bread	13.26	
		"	Supper	Corn starch pudding	14.01	
				Total	283.69	
20059	Syrup	Sept.29-Oct.5		Syrup	10.72	
20061	Salt	" "	" "	Salt	0.35	

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of food used. Kilos.	
20053	White Bread, and cake.	Sept.29	Breakfast	White bread	7.00	One-eighth of amount used taken for sample.
		"	Dinner	" "	6.22	
		Sept.30	Breakfast	" "	6.71	
		"	Dinner	Crackers	1.55	
		"	Supper	White bread	7.00	
		"	"	Ive cookies	2.99	
		Oct.1	"	White bread	4.54	
		"	"	Ginger bread	5.84	
		Oct.2	Breakfast	White bread	7.38	
		Oct.3	"	" "	6.27	
		"	Supper	" "	5.03	
		"	"	Biscuits	5.29	
		Oct.4	Dinner	White bread	6.75	
		"	"	Crackers	1.56	
		"	Supper	White bread	6.30	
		"	"	Ive cookies	2.85	
		Oct.5	Breakfast	Toast	1.36	
		"	"	White bread	7.41	
		"	Supper	" "	4.80	
		"	"	Coffee cake	3.61	
				Total	100.46	
20055	Coffee and Tea.	Sept.29	Breakfast	Coffee	24.27	One-eighth of amount used taken for sample.
		"	Dinner	"	25.22	
		"	Supper	Tea	23.09	
		Sept.30	Breakfast	Coffee	20.79	
		"	Supper	Tea	23.81	
		Oct.1	Breakfast	Coffee	22.78	
		"	Dinner	"	25.44	
		"	Supper	Tea	25.26	
		Oct.2	Breakfast	Coffee	27.95	
		"	Dinner	"	29.15	
		"	Supper	Tea	25.51	
		Oct.3	Breakfast	Coffee	25.98	
		"	Dinner	"	25.64	
		"	Supper	Tea	26.80	
		Oct.4	Breakfast	Coffee	22.90	
		"	Supper	Tea	29.00	
		Oct.5	Breakfast	Coffee	25.08	
		"	Dinner	"	23.95	
		"	Supper	Tea	22.57	
				Total	475.19	

TABLE 10. (Concluded).

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Weight of Food Used. Kilos.	
20057	Butterine	Sept.29.	Breakfast	Butterine	0.57	One-
		"	Dinner	"	0.55	fourth
		"	Supper	"	0.60	of
		Sept.30	Breakfast	"	0.58	amount
		"	Dinner	"	0.70	used
		"	Supper	"	0.86	taken
		Oct.1.	Breakfast	"	0.68	for
		"	Dinner	"	0.57	sample.
		"	Supper	"	0.67	
		Oct.2.	Breakfast	"	0.71	
		"	Dinner	"	0.62	
		"	Supper	"	0.60	
		Oct.3.	Breakfast	"	0.63	
		"	Dinner	"	0.77	
		"	Supper	"	0.67	
		Oct.4.	Breakfast	"	0.62	
		"	Dinner	"	0.65	
		"	Supper	"	0.66	
		Oct.5	Breakfast	"	0.61	
		"	Dinner	"	0.69	
		"	Supper	"	0.83	
				Total	13.84	

Lab. No.	Sample.	Date.	Meal.	Kind of Food.	Amount. Kilos.	
20060	Waste Food.	Sept.29	Breakfast	Waste	5.73	Total
		"	Dinner	"	6.92	amount
		"	Supper	"	9.24	taken
		Sept.30	Breakfast	"	3.99	for
		"	Dinner	"	4.89	sample
		"	Supper	"	10.31	
		Oct.1	Breakfast	"	7.59	
		"	Dinner	"	4.84	
		"	Supper	"	3.90	
		Oct.2	Breakfast	"	4.55	
		"	Dinner	"	7.53	
		"	Supper	"	10.28	
		Oct.3	Breakfast	"	6.35	
		"	Dinner	"	7.18	
		"	Supper	"	4.35	
		Oct.4	Breakfast	"	7.79	
		"	Dinner	"	4.62	
		"	Supper	"	5.15	
		Oct.5	Breakfast	"	17.34	
		"	Dinner	"	10.91	
		"	Supper	"	5.01	
				Total,	148.47	

TABLE 11. SUMMARY. DIETARY STUDY NO.2. CORN DIET.

Labor-atory No.	Food Material.	Weight of Food Used.	Protein.		Carbohydrates.		Fat (Ether extract).		Fuel Value.	Ash. (Mineral matter).		Phosphorus.	
			Per cent.	Quantity.	Per cent.	Quantity.	Per cent.	Quantity.		Per cent.	Quantity.	Per cent.	Quantity.
		Kilos.		Grams.		Grams.		Grams.	Calories.		Grams.		Grams.
20051	Animal Foods	73.56	10.37	7628.17	4.68	3442.61	11.30	8312.28		1.97	1449.13	0.113	83.12
20052	Vegetable Foods	268.41	2.03	5448.72	13.61	36530.60	0.73	1959.39		1.18	3167.24	0.046	123.47
20053	White Bread, etc.	100.46	9.52	9563.79	56.63	56890.50	2.87	2883.20		1.25	1255.75	0.116	116.53
20054	Mixed Foods	86.08	1.94	1669.95	14.44	12429.95	0.69	593.95		0.65	559.52	0.032	27.55
20055	Coffee and Tea	475.19	0.03	142.56	1.32	6272.51	0.02	95.04		0.05	237.60	-----	-----
20056	Milk	89.07	3.10	2761.17	4.87	4337.71	2.67	2378.17		0.71	632.40	0.093	82.84
20057	Butterine	13.84	0.53	73.35	----	-------	87.25	12075.40		3.66	506.54	0.016	2.21
20058	Corn Foods	283.69	4.05	11489.44	29.47	83603.44	2.75	7801.48		1.57	44453.93	0.105	297.87
20059	Syrup	10.72	0.16	17.15	76.00	8147.20	0.05	5.36		1.05	112.56	0.006	0.64
20061	Salt	0.35	----	-------	-----	-------	-----	-------		99.77	349.20	-----	-------
Total in Food Used,				38794.30		211654.52		36104.27			12723.87		734.23
20060	Waste Food	148.47	3.10	4602.57	20.48	30406.66	3.56	5285.53		1.20	1781.64	0.062	92.05
Amount actually consumed[1]				34191.73		181247.86		30818.74			10942.23		642.18
Average - per man per day				87.22		462.37		78.62	2898		27.91		1.64
Average - per kilo body weight[2]				1.39		7.37		1.25	46.2		0.45		0.026

[1] Net amount for seven days, 56 subjects.
[2] Average body weight - 62.7 Kilos.

78.62 grams. The fuel value of these is 2898 calories. On an average, each man ingested per day, 27.91 grams of mineral matter (ash) of which 1.64 grams was phosphorus.

Per kilo body weight, the average consumption per man per day is equal to 1.39 grams protein, 7.37 grams carbohydrates; 1.25 grams fat; 46.2 calories energy; 0.45 gram ash; and 0.026 gram phosphorus.

Discussion of Results.

These values are considerably higher than those obtained with the General diet. Compared to Atwater's standards, both for insane institutions and for men in health engaged in equivalent muscular activity ("man with light to moderate muscular work"), the diet is somewhat deficient in protein but practically adequate in fuel value. But Atwater's standard for the insane is based on a food consumption of 86 grams protein and 2700 calories, values which are not as great as those obtained with the Corn diet. Compared with the results obtained in the New York, Connecticut, and Washington, D.C. institutions, the Corn diet appears entirely satisfactory.

In the investigations with normal men at the University of Illinois,[34] smaller quantities of protein and the same quantities of energy were found entirely adequate.

Considering the character of the patients, however, and the fact that the results obtained represent the average of a large number of subjects, some of whom were undoubtedly

receiving less than the average, it is fair to assume that the amounts of nutrients and energy actually consumed are not excessive. A fair conclusion regarding the Corn diet would seem to be that, in so far as the data go, it was entirely satisfactory and adequate.

Distribution of Nutrients.

The distribution of nutrients among the different foods and classes of foods has been determined as in the case of the General diet. The data are arranged in Table 12.

The remarks regarding the protein, fat, and carbohydrate that were made in describing Table 8, apply also to these results.

The corn foods are classed with the mixed foods because they included many dishes, such as puddings and custards, which contained eggs and milk. The total mixed foods, then, derived considerable of their nutrients from animal sources, a fact to be remembered in judging the diet.

Total Food Used.

The total vegetable foods supply 60.99 per cent of the total food used; total animal foods, 11.61 per cent; total mixed food, 27.37 per cent; and salt 0.02 per cent.

Dry Substance: Of the total dry substance, 44.37 per cent comes from the total vegetable foods, 10.34 per cent from the total animal foods, 45.17 per cent from total mixed

TABLE 12. DISTRIBUTION OF NUTRIENTS. DIETARY STUDY NO.2. CORN DIET.

Laboratory No.	Food Material.	Fresh Food. Quantity.	Per cent of total.	Per man per day.	Dry Substance. Quantity.	Per cent of total.	Per man per day.	Protein. Quantity.	Per cent of total.	Per man per day.	Carbohydrates. Quantity.	Per cent of total.	Per man per day.
		Kilos.		Grams.	Kilos.		Grams.	Grams.		Grams.	Grams.		Grams.
20051	Animal Foods	73.56	5.25		20.83	6.96		7628.17	19.66		3442.61	1.63	
20056	Milk	89.07	6.36		10.11	3.38		2761.17	7.12		4337.71	2.05	
Total	Animal Foods	162.63	11.61	414.87	30.94	10.34	78.93	10389.34	26.78	26.50	7780.32	3.68	19.84
20052	Vegetable Foods	268.41	19.15		47.11	15.75		5448.72	14.05		36530.60	17.26	
20053	White bread, etc.	100.46	7.17		70.59	23.60		9563.79	24.65		56890.50	26.88	
20055	Coffee and Tea	475.19	33.91		6.75	2.26		142.56	0.37		6272.51	2.96	
20059	Syrup	10.72	0.76		8.28	2.77		17.15	0.04		8147.20	3.85	
Total	Vegetable Foods	854.78	60.99	2180.56	132.73	44.37	338.59	15172.22	39.11	38.70	107840.81	50.95	275.10
20054	Mixed Foods	86.08	6.14		15.25	5.10		1669.95	4.30		12429.95	5.87	
20057	Butterine	13.84	0.99		12.51	4.18		73.35	0.19		-------	-----	
20058	Corn Foods	283.69	20.24		107.35	35.89		11439.44	29.62		83603.44	39.50	
Total	Mixed Foods	383.61	27.37	978.60	135.11	45.17	344.67	13232.74	34.11	33.76	96033.39	45.37	244.98
20061	Salt	0.35	0.02	0.89	0.35	0.17	0.89	-------	-----	------	-------	-----	------
Total	Food Used	1401.37	100.00	3574.92	299.13	100.00	763.09	38794.30	100.00	98.96	211654.52	100.00	539.94
20060	Waste Food	148.47	10.59	378.75	42.08	14.07	107.33	4602.57	11.86	11.74	30406.66	14.37	77.57
Amount actually consumed		1252.90	89.41	3196.17	257.05	85.93	655.75	34191.73	88.14	87.22	181247.86	85.63	462.37

TABLE 12. (Cont.). DISTRIBUTION OF NUTRIENTS. DIETARY STUDY NO.2. CORN DIET.

Laboratory No.	Food Material.	Fat. Quantity.	Fat. Per cent of total.	Fat. Per man per day.	Fuel Value. Per cent of total.	Fuel Value. Per man per day.	Ash. Quantity.	Ash. Per cent of total.	Ash. Per man per day.	Phosphorus. Quantity.	Phosphorus. Per cent of total.	Phosphorus. Per man per day.
		Grams.		Grams.		Calories.	Grams.		Grams.	Grams.		Grams.
20051	Animal Foods	8312.28	23.02				1449.13	11.39		83.12	11.32	0.21
20056	Milk	2378.17	6.59				632.40	4.97		82.84	11.28	0.21
Total	Animal Foods	10690.45	29.61	27.27	12.68	428	2081.53	16.36	5.31	165.96	22.60	0.42
20052	Vegetable Foods	1959.39	5.43				3167.24	24.89		123.47	16.82	0.31
20053	White Bread, etc.,	2883.20	7.99				1255.75	9.87		116.53	15.87	0.30
20055	Coffee and Tea	95.04	0.26				237.60	1.87		-----	-----	-----
20059	Syrup	5.36	0.01				112.56	0.88		0.64	0.09	0.00
Total	Vegetable Foods	4942.99	13.69	12.61	40.50	1367	4773.15	37.51	12.18	240.64	32.78	0.61
20054	Mixed Foods	593.95	1.65				559.52	4.40		27.55	3.75	0.07
20057	Butterine	12075.40	33.45				506.54	3.98		2.21	0.30	0.01
20058	Corn Foods	7801.48	21.60				4453.93	35.00		297.87	40.57	0.76
Total	Mixed Foods	20470.83	56.70	52.22	46.82	1580	5519.99	43.38	14.08	327.63	44.62	0.84
20061	Salt	-------	-----	-----	-----	----	349.20	2.75	0.89	-----	------	----
Total	Food Used	36104.27	100.00	92.10	100.00	3375	12723.87	100.00	32.46	734.23	100.00	1.87
20060	Waste Food	5285.53	14.64	13.48	14.13	477	1781.64	14.00	4.55	92.05	12.54	0.23
Amount	actually consumed	30818.74	85.36	78.62	85.87	2898	10942.23	86.00	27.91	642.18	87.46	1.64

food, and 0.17 per cent from salt.

Since the total mixed foods contain considerable material of animal origin (in the corn foods) the proportion of animal foods is probably somewhat larger than the table shows. The importance of corn products is apparent from the fact that 35.89 per cent of the total dry substance is furnished by foods containing such material.

Protein: The total vegetable foods furnish 39.11 per cent of the total protein; the total animal foods, 26.78 per cent ; and the total mixed foods, 34.11 per cent. The corn foods, which contain material from animal sources, supply 29.62 per cent of the total protein.

Carbohydrates are distributed among the various classes of foods as follows: total vegetable foods, 50.95 per cent; total animal foods, 3.68 per cent; and total mixed foods, 45.37 per cent. The presence of carbohydrates in the animal foods (meats and cheese) is explained in the same manner as that of the corresponding sample in the first study, viz., it is due chiefly to the flour added to the beef stew.

Fat is derived chiefly from the total mixed foods. Of these, butterine supplies 33.45 per cent of the total quantity in the diet, and the corn foods, 21.60 per cent. The total animal foods furnish 29.61 per cent and the total vegetable foods only 13.69 per cent.

Fuel value: The total mixed foods, too, yield the greatest proportion of energy, 46.82 per cent of the total

amount. 40.50 per cent is derived from the total vegetable foods and 12.68 per cent from the total animal foods.

Ash (mineral matter). The total vegetable foods supply 37.51 per cent of the total ash of the diet; the total animal foods, 16.36 per cent; the total mixed foods, 43.38 per cent and the salt, 2.75 per cent. The corn foods alone supply 35 per cent. The prominent position of the corn products in this diet is evident everywhere.

Because it was necessary to class the corn foods with the mixed foods and since a better separation of the foods into animal and vegetable is not possible, it is difficult to compare this diet with the General diet and the average American diet from the standpoint from animal and vegetable food content. It is certain, however, that this diet approaches much nearer the balance of the average American dietary than does the General diet.

An interesting point in this connection, is the place milk occupies in this diet. The Corn diet contained a larger amount of milk than did the general diet and the result is evident in the increased proportion of all nutrients, including ash and phosphorus, credited to this food material.

Comparison of the Diets.

In Table 13, the quantities of food used, dry substance, energy, and nutrients per man per day, as derived from the different classes of foods, are arranged for the two diets studied

TABLE 13. COMPARISON OF THE CORN AND GENERAL DIETS.

Expressed as quantities per man per day.

		Fresh Food. Grams.	Dry Substance. Grams.	Protein. Grams.	Carbohydrates. Grams.	Fat. Grams.	Energy. Calories.
Total Animal Foods.	General Diet	222.44	57.86	24.07	8.87	21.09	319
	Corn Diet	414.87	78.93	26.50	19.84	27.27	428
Total Vegetable Foods	General Diet	2234.61	506.56	49.98	433.61	6.30	1991
	Corn Diet	2180.56	338.59	38.70	275.10	12.61	1367
Total Mixed Foods	General Diet	241.81	71.06	4.23	31.46	32.60	433
	Corn Diet	978.60	344.67	33.76	244.98	52.22	1580
Salt	General Diet	1.75	1.75	-----	-----	-----	----
	Corn Diet	0.89	0.89	-----	-----	-----	---
Total Food Used	General Diet	2700.62	637.22	78.28	473.94	60.00	2743
	Corn Diet	3574.92	763.09	98.96	539.94	92.10	3375
Waste Food	General Diet	145.05	40.73	4.77	29.60	4.23	175
	Corn Diet	378.75	107.33	11.74	77.57	13.48	477
Amount actually consumed	General Diet	2555.57	596.49	73.51	444.34	55.77	2568
	Corn Diet	3196.17	655.75	87.22	462.37	78.62	2898

so as to facilitate a comparison. The most noticeable facts are:-

1. The group receiving the Corn diet was served more food and more nutrients and energy per man per day than the group on the General diet.

2. Larger quantities of animal foods were supplied by the Corn diet than by the other. This is especially evident when it is remembered that considerable of the corn foods, classed with the mixed foods, is derived from animal substances.

3. The amount of food wasted (left uneaten at the tables) is much greater on the Corn diet than on the General diet.

4. The amount of food actually eaten (total food, energy and nutrients) is much greater on the Corn diet than on the General diet.

An observation of the menus of the two diets for the periods in which the studies were made show at once that the Corn diet is much superior to the General diet. There is a greater variety of food. It contains more dishes of the kind that appeal to the appetite and taste, such as custards and puddings, and more of that valuable food material, milk. This does not mean that the General diet was not a good diet or that it did not contain good wholesome food. It did possess those necessary qualities. What it lacked was the variety of the Corn diet, and it was due in all probability, to the greater variety in the Corn diet that those who received it consumed more food than those receiving the General diet. In

both studies, food was left uneaten that might have been consumed, and in both studies, the food was good and wholesome. This might be taken to mean that the food actually eaten was adequate to the needs of the subjects. However, since other conditions were practically the same, the greater consumption on the Corn diet must be attributed to the superior character of the diet.

It is not sufficient, alone, to supply good wholesome food. Variety must be introduced into the diet and monotony prevented, if the consumption of adequate quantities of food and nutrients is to be assured.

DIETARY STUDY NUMBER 3. CORN-FREE DIET.

It was greatly to be regretted that it was impossible to conduct a complete dietary study of the Corn-free diet. Such work was begun and carried on for two days. No samples were kept and no analyses were made, but the quantities of food sent to the dining room, returned, wasted and actually eaten during the two days were determined. These make possible, in a very general way, comparisons with the other two diets.

The Corn-free diet differed from the Corn diet only in that it contained no corn products of any kind. When such a food was used in the one diet, some other of equal value was served in the Corn-free diet. Both diets were about on the same plane of nutrition as can readily be seen by consulting the menus for the week. (Table 4.)

The patients were of the same type as those receiving

TABLE 14. COMPARISON OF CORN AND CORN-FREE DIETS. QUANTITIES OF FOOD USED, PER MAN, PER DAY, DURING THE FIRST TWO DAYS OF EXPERIMENT.

Kind of Food.	Weights of Food Used. Per man per day.(gms.) Corn Diet.	Corn-Free Diet.
Animal Foods,	289.73	301.23
Milk,	336.52	352.98
Coffee and Tea,	1046.25	1099.56
Butterine,	34.46	45.44
Other Foods,[1]	1736.60	1984.82
Total - Food Used,	3443.56	3784.03
Waste Food,	366.79	470.70
Amount actually consumed,	3076.77	3313.33

[1] Includes for:

Corn Diet.	gms.	Corn Free Diet.	gms.
Vegetable Foods,	651.16	Vegetable Foods,	983.68
White Bread,etc.	280.98	White Bread,etc.	430.88
Mixed Foods,	169.46	Mixed Foods,	570.26
Corn Foods,	635.00		
Total,	1736.60	Total,	1984.82

the Corn diet. There were fifty-seven subjects in this group.

The weights of food used, wasted and actually eaten have been calculated to a man per day basis. For comparison the same thing has been done for the first two days of the Corn diet. These results are given on the nextpage.(Table 14.)

They show a somewhat higher consumption on the Corn-free diet than on the Corn diet. Since both were on about the same nutritive plane, this fact suggests the possibility that the group on the Corn-free diet were ingesting more nutrients than the others. The data are not sufficient to allow such a broad conclusion, however, but it seems safe to say that the two groups were probably equally well nourished.

These figures tend to corroborate the conclusions stated above in comparing the Corn and General diets, viz., that the character of the diet is a most important factor in determining the amount of food consumed.

THE MINERAL SUBSTANCES IN THE GENERAL AND CORN DIETS.

Very little definite information is available regarding the requirements of normal men for the mineral substances. Dietary studies do not include the estimation of these important dietary constituents. Langworthy[32] gives an estimate of the mineral matter required per man per day, based upon the conclusions of Van Noorden and Sherman. They are as follows:

Phosphoric acid (P_2O_5)....3 to 4 grams.
Sulphuric acid (SO_3).....2 to 3.5 grams.
Potassium oxide.....2 to 3 grams.
Sodium oxide.....4 to 6 grams.
Calcium oxide.....0.7 to 1.0 gram.
Magnesium oxide.....0.3 to 0.5 gram.
Iron.....0.006 to 0.012 gram.
Chlorine.....6 to 8 grams.

Upon this basis and providing that the various substances are present in the proper proportions, the mineral matter in both diets studied appears to be sufficient. On the General diet, 23.23 grams, and on the Corn-free diet 27.91 grams of total mineral matter were consumed per man per day.

Phosphorus.

The only constituent of the ash determined in these studies was phosphorus. Calculated as the element(P) the subjects receiving the general diet ingested daily 1.07 gram (Table 7) and the subjects on the Corn diet, 1.64 gram, (Table 11). These quantities are equivalent to 2.45 and 3.82 grams phosphoric acid (P_2O_5), respectively.

The following table gives the quantities of phosphoric acid in twenty typical American dietaries, as determined by Sherman, Mettler, and Sinclair[29]. To these are added the values for the diets at the Peoria State Hospital.

Table 15. Phosphoric Acid Contents of Twenty Typical American Dietaries According to Sherman.

Persons studied.	Quantities per man per day. Fuel Value, calories.	Protein, grams.	Phosphoric Acid, grams.
Maine lumberman	6780	179	5.88
School superintendant's family, Chicago	3260	123	3.97
Student's club, University of Tennessee	3595	123	4.05
Decorator's family, Pittsburg	3305	112	3.44
Farmer's family, Connecticut	3545	108	3.53
Teacher's family, Indiana	2780	106	3.64
Teacher's family, New York City	3180	102	3.92
Mechanic's family, Tennessee	4060	97	3.58
Farmer's and Mechanic's family, Tennessee	2820	95	3.56
Glass blower's family, Pittsburg	3085	94	2.73
Lawyer's family, Pittsburg	3280	91	2.82
Women student's club, Ohio	3330	85	2.88
Laborer's family, New York City	2335	84	2.41
Laborer's family, Pittsburg	2525	83	2.40
Negro farmer's family, Alabama	4955	80	3.25
Laborer's family, New York City	2430	71	2.27
Farm student's club, Tennessee	3560	66	2.08
Serving woman's family, New York City	1500	54	1.84
Very poor negro family, Alabama	2240	44	2.05
Laborer's family, Pittsburg	2440	77	1.52
Peoria State Hospital, General Diet	2568	73.5	2.45
Peoria State Hospital, Corn Diet	2898	87.2	3.82

Regarding their results the authors say:-

"From the results here obtained, as well as from the average results of experimants by other observers, it would appear that

a healthy man, accustomed to full diet of the ordinary mixture of animal and vegetable materials, requires for the maintenance of his ordinary store of phosphorus compounds about 1.5 grams phosphorus or nearly 3.5 grams phosphoric acid, per day, though under special conditions or with a specially selected dietary, equilibrium may be maintained on much less. Many of the dietaries studied show so much less than 3.5 grams phosphoric acid per man per day as to raise a question whether the people may not have been undernourished in this respect, even though they may have had ample protein, fats and carbohydrates. This question merits further investigation."

Grindley et al [34], in the work already referred to, determined the phosphorus intake of the 21 men for the entire period of 220 days. The average quantity ingested for the entire experiment was 1.45 grams per man per day. Per kilo body weight, each man received per day, 0.0218 gram. Compared to these values, the 1.07 gram phosphorus per man per day, or 0.016 gram per kilo body weight, received by the group on the General diet, would seem to be inadequate.

The Corn diet, judged by the values quoted, is satisfactory in regard to the phosphorus content.

Aron and Hocson [27], in their investigations on beriberi found that a diet furnishing 40 calories , 0.15 gram nitrogen, and 0.025 gram P_2O_5 per kilo body weight was too poor in nitrogen and P_2O_5 and caused loss of both from the body. A diet furnishing 37 calories, 0.2 gram nitrogen and 0.032 gram P_2O_5

per kilo body weight was sufficient to keep a man in nitrogen and P_2O_5 equilibrium. The subjects of the studies were Filipinos. These values are much smaller than those found by European and American experimenters.

The general diet supplied 38.3 calories, 1.10 grams protein, and 0.037 gram P_2O_5 per kilo body weight, values which are practically equivalent to those that Aron and Hocson found necessary to maintain nitrogen and phosphorus equilibrium. They are much lower, however, than the quantities of phosphorus called for as necessary by European and American investigators (Magnus-Levy[11], Sherman et al[16],) viz., 3 to 4 grams P_2O_5 per day.

To return to a method of interpretation used before, the following conclusion seems reasonable. The quantity of phosphorus, 1.07 grams per man per day (equivalent to 2.45 grams phosphoric acid per man per day) is low compared to what is usually considered necessary. It represents the average daily ingestion of a large group of subjects. Some of these were probably receiving less than the average. In that case, they were very likely receiving too little, and from this point of view, must have been in phosphorus starvation.

Phosphorus Starvation has been associated with a disease of nervous origin (beriberi). The importance of this element cannot be overestimated, especially when dealing with the insane. It is highly desirable that more work be done along this line to determine the requirements for this element and its functions in nutrition.

The Corn-diet supplied 3.82 grams P_2O_5 per man per day or 0.061 gram phosphorus per kilo body weight. Since the quantities of protein and energy, 1.39 grams and 46.2 calories per kilo body weight, are sufficient, this diet is adequate with respect to the phosphorus content.

Sources of Phosphorus.

Tables 8 and 12 give the distribution of the phosphorus among the various foods and classes of foods, proportionally and quantitatively. On the General diet, 65.81 per cent of the total phosphorus was derived from the total vegetable foods, 27.31 per cent from the total animal foods and 6.88 per cent from the total mixed foods. On the Corn diet, the total vegetable foods supplied 32.78 per cent of the total phosphorus, the total animal foods, 22.60 per cent; and the total mixed foods, 44.62 per cent. The greater proportion in the total mixed foods is due to the corn foods which alone supplied 40.57 per cent of the total phosphorus. The greater quantity, per man per day, furnished by the Corn-diet, compared with the General diet, is derived from two kinds of food entirely, the corn foods and milk. The corn foods alone supplied 0.76 gram per man per day and the milk, 0.21 gram per man per day. Possibly considerable of the phosphorus in the corn foods comes from the animal substance (eggs and milk) used in the preparation of many dishes included under this head. Milk is an excellent source of phosphorus.

In the nutrition investigations of Grindley et al[34] the phosphorus of the average diet was derived as follows:- from animal foods, 54.73 per cent; from vegetable foods, 31.74 per cent; from mixed foods, 13.52 per cent. The chief source of phosphorus was milk, which supplied 37.76 per cent of the total amount. Meats were the next important source, supplying 16.03 per cent.

These facts are of interest and value in suggesting means for increasing the phosphorus in such a diet as the General diet.

WASTE FOOD.

Of importance from the economic standpoint is the proportion of food material wasted. Waste cannot be entirely prevented even under the best conditions. Regarding this matter, Atwater says[15], "In nearly 200 dietary studies made in the United States in connection with the food investigations which are being carried out by the United States Department of Agriculture, the amount of waste has ranged from practically none to 8 or 10 per cent of the whole food in private families; while in boarding houses, even when economy was sought, it has reached 10 per cent and,in individual instances, nearly 20 per cent." In the New York State Hospitals, he found the total shrinkage and loss to be at least 25 per cent and possibly 33 1/3 per cent.

In the Connecticut hospital, the table waste amounted to 12.6 per cent of the total protein and 10.5 per cent of the total energy, in the first study. In the other, 19.2 per cent

of the protein and 14.5 per cent of the energy were wasted in this way. In the New York hospitals, the waste food varied considerably in the different studies, but on the whole, it was probably somewhat greater than in the Connecticut institution. In the Government hospital at Washington, the waste of protein varied from 10 to 26 per cent and of energy, from 8 to 24 per cent.. The average table waste for all studies with patients was, protein, 15 per cent and energy, 13 per cent. The Bayview (Baltimore) studies show a much smaller waste, the average of four studies being, protein 3 per cent and energy 3 per cent.

Richards and Wentworth[11] consider 10 per cent a sufficient allowance for shrinkage and waste. This is probably too small.

In the studies at the Peoria State Hospital, no attempt was made to determine the total waste. The table waste was collected, however, and analysed. The proportion of the total food that was wasted in this way was; on the General diet, protein, 4.77 per cent and energy, 6.38 per cent; on the Corn diet; protein, 11.86 per cent and energy, 14.15 per cent. These values are not excessive compared to those found in other institutions, although the waste on the Corn diet could probably have been reduced. As explained previously, the food was sent to the dining room in metal boxes. Here it was served out on the plates etc., before the patients were permitted to enter and take their places. The work of dishing out the food was done by a number of the more intelligent patients, under the direction of one of the attendants. The care with which it was done

depended almost entirely upon the interest the attendant took in her duties. This was very little in the caseof the Corn-diet. Practically all the food was distributed uniformly to all the patients, whether it was likely to be eaten or not. There was no chance of recovering it in its original form after the meal. Conditions were much better in the other group. In fact everything appeared to be as well regulated as could be expected. The differences in these conditions explain, in part at least, why the waste food in the first study amounted to only 53.86 kilos for the week and in the second, to 148.47 kilos. The fact that much more food, in greater variety, was sent to the Corn diet group than to the tother, accounts in part for the larger waste, too, but, all things considered, it is undoubtedly true that the greater care and attention of the employees in charge of the General diet group has been beneficial economically; and, of course, physiologically as well.

The foregoing refers to table waste. There was another form of waste found which appeared to amount to considerable. The food sent to the cottages was supposed to be just about right in amount. The metal containers, suposedly entirely empty, were cleaned before they were returned to the kitchen. Any food that could not be saved for thenext meal, was discarded and used for feeding hogs. It was the duty of the attendants and supervising nurse to see that the proper quantities of food were sent to the dining rooms. During the time of the studies, no supervision was made, and it was noticed at once what quantities

of food were wasted in this way. No accurate and complete determination of the quantities thus wasted was possible in these studies. It may be considered, however, that all the food returned to the kitchen during these experiments was wasted. Some of this, of course, might have been saved from one meal to the next. Since there was practically always some food left over, such quantities were superfluous and to all practical purposes, wasted. The quantities of food sent to the dining room, the quantities used and the proportions of food sent that were used and returned, are given in Tables 16 and 17. It must be remembered that some food would naturally remain sticking to the sides of the containers, and that it was not always practical or possible to send the exact quantities necessary. On the other hand, in some cases, the waste caused in this way appears excessive and a more careful supervision of this phase of the food supply would no doubt prove valuable.

In Study No. 1 (General diet) this form of waste varied from practically none in the case of peach pie and sausage to 71 per cent in the case of macaroni and cheese. Some of the material such as crackers, prunes, beet pickles, and other vegetables might possibly be saved in the dining room and used at the following meal. There appeared to be no systematic attempt to utilize such material, however.

In Study No. 2 (Corn diet) this form of waste varied from practically none in the case of squash pie and pastry goods to 43 1/2 per cent in the case of toast in custard. In this dining room there was practically no attempt made to save

TABLE 16. QUANTITIES AND PER CENTS OF TOTAL FOOD SENT TO DINING ROOM THAT WERE USED AND THAT WERE RETURNED (ORDINARILY WASTED).

DIETARY STUDY NO.1. GENERAL DIET.

(Quantities for entire week).

Kind of food.	No. times served.	Food sent to dining room. Kilos.	Food used. Kilos.	Proportion to total sent that was Used. P.ct.	Returned. P.ct.
Bread	21	156.21	130.61	83.61	16.39
Crackers	2	4.74	3.56	75.11	24.89
Boiled rice	4	71.59	65.66	91.72	8.28
Coffee and tea	19	536.85	294.36	54.83	45.17
Steamed potatoes	7	77.70	55.05	70.85	29.15
Sliced cucumbers	1	8.87	5.94	66.97	33.03
Beet pickles.	1	10.12	7.77	76.78	23.22
Lima beans	1	13.76	12.15	88.30	11.70
Hominy	2	41.72	33.44	80.15	9.85
Oatmeal	1	14.87	14.70	98.86	1.14
Cornmeal mush	2	29.34	26.72	91.07	8.93
Boiled cabbage	2	29.27	22.38	76.46	23.54
Green beans and potatoes	3	57.18	53.11	92.88	7.12
Creamed onions	1	16.07	10.30	64.09	35.91
Vegetable soup	2	56.55	33.91	59.96	40.04
Peach tapioca	1	26.95	21.19	78.63	21.37
Navy beans	2	32.56	31.61	97.08	2.92
Rhubarb sauce	1	15.60	13.33	85.45	14.55
Macaroni and cheese	1	13.93	4.03	28.93	71.07
Peach pie	1	7.88	7.88	100.00	-----
Stewed prunes	2	39.48	21.22	53.75	46.25
Lentils	1	15.91	15.73	98.89	1.13
Onions (sliced)	1	6.42	3.08	47.98	52.02
Beef stew	3	45.80	45.23	98.75	1.25
Cheese	2	7.24	6.82	94.20	5.80
Sausage	1	6.48	6.48	100.00	-----
Butterine	17	14.76	12.48	84.55	15.45
Milk	2	24.13	24.07	99.75	0.25

TABLE 17. QUANTITIES AND PER CENTS OF TOTAL FOOD SENT TO DINING ROOM THAT WERE USED AND THAT WERE RETURNED (ORDINARILY WASTED).

DIETARY STUDY NO.2. CORN DIET.
(Quantities for entire week).

Kind of food.	No. times served.	Food sent to dining room. Kilos.	Food used. Kilos.	Proportion of total sent that was Used. P.ct.	Returned. P.ct.
White Bread	12	83.75	75.41	90.04	9.96
Crackers	2	4.36	3.11	71.33	28.67
Ive cookies,	2				
Ginger bread	1	Practically all used.		No waste.	
Coffee cake	1				
Biscuits	1				
Toast	1	1.64	1.36	82.93	17.07
Corn starch pudding	3	52.84	39.51	74.77	25.23
Toast in custard	1	14.50	8.18	56.41	43.59
Cocoanut pudding	1	17.89	12.38	69.20	30.80
Corn fritters	1	7.17	6.85	95.54	4.46
Tapioca pudding	1	16.83	15.04	89.36	10.64
Bread pudding	1	14.89	9.97	66.96	33.04
Squash pie	1	4.62	4.62	100.00	-----
Rice pudding	1	20.75	17.01	81.98	8.02
Stewed prunes	2	30.99	18.40	59.37	40.63
Corn bread	9	149.39	130.82	87.57	12.43
Hominy	2	34.20	33.42	97.72	2.28
Corn flakes	2	3.25	3.25	100.00	-----
Oatmeal	2	28.85	24.03	83.29	16.71
Cornmeal mush	1	16.79	12.92	76.95	23.05
Canned corn	3	48.61	36.36	74.80	25.20
Butterine	21	19.08	13.84	72.54	27.46
Milk	9	97.23	89.07	91.61	8.39
Cheese	1	3.43	3.36	97.96	2.04
Beef soup	2	55.42	39.44	71.17	28.83
Beef stew	4	62.20	58.69	94.36	5.64
Ssusage	1	8.06	7.40	91.81	8.19
Frankforters	1	5.70	4.11	72.11	27.89
Cabbage	3	50.26	49.91	99.30	0.70
Whole tomatoes	3	34.13	32.62	95.58	4.42
Stewed tomatoes	2	30.40	29.20	96.05	3.95
Creamed potatoes	1	16.21	10.92	67.36	32.64
Mashed potatoes	1	15.56	9.61	61.76	38.24
Steamed potatoes	1	11.11	9.04	81.37	18.63
Baked potatoes	1	10.68	8.20	76.78	23.21
Boiled potatoes	1	16.70	16.51	98.86	1.14
String beans	1	13.99	8.12	58.04	41.96
Navy beans	1	16.21	13.55	83.59	26.41
Lima beans	1	16.45	10.49	63.77	36.23
Lentils	1	17.95	11.13	62.00	38.00
Macaroni and tomatoes	1	14.60	13.87	95.00	5.00
Coffee and tea	19	543.65	475.19	87.41	12.59

this good food. All the work was left to the patients, who were unable to attend to it properly.

SUMMARY.

The lack of definite information regarding the food requirements and the metabolism of the class of subjects experimented upon has made it difficult to interpret the results obtained in these studies. In addition to this fact, the experimental work here reported is in itself too brief to allow any broad conclusions. Bearing these facts in mind, the work included in this thesis may be summarized as follows:

STATISTICS AND LITERATURE.

1. In 1908, there were 24,965 inmates in the state and county public institutions, excepting the county and city jails, in the State of Illinois. Of these, 12,285 were classed as insane.

2. Among the most important problems that the officers of these institutions are confronted with is that of feeding the inmates. The scientific management of the dietetics of such institutions seems highly desirable and would be beneficial both to the taxpayers who support the institutions and to the inmates.

3. The insane, forming by far the largest class of public dependents, present problems, in regard to their food requirements, which are different in many respects from those of other classes. A review of the literature on the

subject of dietary studies in public institutions for the insane shows that very little work, comparatively speaking, has been accomplished. The most extensive work of this character is that carried out by Atwater and his associates. In general, the lack of uniformity of results and the meagreness of information regarding the food requirements of the insane, emphasizes the need for more work in this direction.

4. This work should take the form of dietary studies and metabolism experiments in which the mineral substances and the character of the dietary constituents should be given due consideration. In such work, a system of classification of the patients should be sought.

5. In institutions for the insane, as well as in all institutions, the preparation and serving of the food should be given special attention, in order to secure the best utilization.

6. Any work that will lead to a better and a clearer understanding of the food requirements and the metabolism of the insane must prove beneficial to the patients and should result in a saving to the community supporting the public institutions.

DIETARY STUDIES AT THE PEORIA STATE HOSPITAL.

I. The General Diet.

1. Measured by the quantities consumed by a group of average patients, fifty-three in number, for a period of seven days, the General diet supplied per man per day, 73.51

grams protein, 444.34 grams carbohydrates, 55.77 grams fat, 2568 calories energy, and 23.23 grams mineral matter, of which 1.07 grams was phosphorus. With the exception of protein and phosphorus, these quantities are probably adequate.

2. It is difficult to judge the adequacy of the protein content because very little information is available regarding the food requirements of the insane. On the whole, the quantity is probably sufficient, but it is probably not in the least excessive, and, since it represents the average intake of a large number, an increase in the amount would seem desirable.

3. The phosphorus intake on the General diet is much smaller than the amount ordinarily considered necessary. For this reason, an increase in this element in the diet would seem to be desirable, but more experimental work is necessary before anything definite can be said regarding this.

5. A study of the distribution of the nutrients among the animal and vegetable foods shows that the diet is chiefly vegetable in nature, much more so than the average American dietary. The influence of this could be determined only by metabolism experiments. However, an increase in animal foods in the diet would result in an increase in the protein and phosphorus contents and would therefore be desirable. Such added animal foods need not necessarily be meats but might include such materials as milk, eggs, and dairy products, if the cost would permit.*

*Since this study was made the meat in the diet has been increased.

II. Corn Diet.

1. The quantities of nutrients, energy, and mineral substances ingested per man per day by the patients receiving the Corn diet were:- protein, 87.22 grams; carbohydrates, 462.67 grams; fat, 78.62 grams; energy, 2898 calories; total mineral matter, 27.91 grams; phosphorus, 1.64 grams.

2. These quantities were probably entirely adequate to the needs of the patients receiving them but cannot be considered excessive.

III. Corn-free Diet.

To judge by the little evidence at hand, the Corn-free diet seems to have been at least equal to the Corn diet.

IV. Importance of the Character of the Diet.

The character of the diet is an important factor in determining the quantities of food and nutrients that will be consumed. Other things being equal, the diets that possessed the greater variety (Corn and Corn-free diets) brought about a larger consumption of nutrients, energy, etc., than the diet lacking much variety (General diet), although in all cases the food was good and wholesome and more was provided than was eaten.

V. Waste Food.

Only one form of waste was accurately determined, viz., "table waste". In neither study was this excessive compared to what it usually is in public institutions. In the second study (Corn diet) it might have been kept down by more care on the part of the attendants.

Another form of waste was noted, which, although not determined exactly, appeared to amount to considerable and might have been prevented.

CONCLUSION.

On the whole, the work reported in this thesis must be considered preliminary. The results obtained, both from the study of the literature and by experiment, are suggestive rather than conclusive. The need for more experimental work has been repeatedly noted. The direction that such efforts should take has been outlined, briefly. Considering the class of subjects, such work would be exceedingly difficult but it is certainly necessary before any definite conclusions can be made regarding the dietetic requirements of the insane. The importance of the matter from an economic standpoint is emphatically demonstrated bythe statistics quoted in the beginning of this thesis. The interests of the poor unfortunate inmates, deprived of all benefits and pleasures of life, demand this service of science.

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