APPENDIX.

Estimation of the Value of a Dietary.

It is important that the practical physician have a knowledge of the approximate value of a dietary, as regards the amount and relations of the proteids, fat, and carbohydrates contained therein. More especially is this the case in children's diets, as many of the artificially prepared food-stuffs now used are deficient in these important constituents or they are not in proper relation. There should be a sufficiency of fat and carbohydrates—more especially *fat*—and it is this constituent of the diet that is so frequently deficient. A rich nitrogenous diet (proteids), deficient in fat and carbohydrates, is not only a wasteful diet, but may be positively injurious, as the excretory organs have daily to eliminate the excess of nitrogen not required by the organism. There is no *storage* of nitrogen in the system similar to the storage of fat, and, therefore, the daily supply offered should be regulated by the nitrogenous tissue of the individual. The daily "output" of nitrogen equals the daily "intake" in the physiologically healthy adult—*i.e.*, he is in nitrogenous equilibrium. A child, to allow for its growth, requires a *slightly* increased amount of nitrogen intake daily, the supply of nitrogen offered being, of course, in relation to the child's weight. In the aged the supply of nitrogen may be diminished. But even supposing the quantity of nitrogenous food taken be correct, the proteid metabolism is modified by the fat stored up in the body, and by the fat present in the food. The fat—besides its other physiological uses—acts as an economiser of the proteids, and prevents excessive proteid metabolism. It is well known that when fat is given in fair quantity in a diet, the nitrogenous equilibrium is attained with a less quantity of proteid food. A diet, therefore, which is defective as regards the quantity of fat, however rich it may be in proteid, *allows* the nitrogenous nourishment to pass through the system so hastily as to result ultimately in body-wasting with loss of weight.*

To estimate the quantities and relations of the proteids, fat, and carbohydrates in a diet, a reference to any good work on food-stuffs will give the percentage composition of their constituents.

The total daily diet may then be calculated. As a guide to ordinary requirements (taking average conditions and moderate work) the relations in a total day's diet should be—for every kilo. (about 2¼ lbs.) of body-weight:—

	Proteids.	Fat.	Carbohydrates.	Calories.
(*About*)	2 grammes.	1·6 grammes.	4·5 grammes	= 41·5

* *Some Effects of Certain Diets upon Excretion by the Kidneys*, by R. S. Aitchison, M.D., 1896.

If the total amounts of proteids and carbohydrates in the daily diet be multiplied by 4·1, and the amount of fat by 9·3, the result will give the total energy value of the diet expressed in *calories*. There should be about 41·5 calories allowed for every kilo. of body-weight.

To estimate the "output" of nitrogen from the system, 10 per cent. must be allowed for the nitrogen lost in the fæces; and if the hypobromite method be used to estimate the quantity of nitrogen in the urine, another 8 per cent. must be allowed for nitrogen which the hypobromite solution fails to estimate. The daily total output of nitrogen may then be considered in relation to the normal output in man, and in relation to the amount estimated, approximately, in the food taken. (See Blyth's *Foods*.)

Analysis of the Stomach Contents (Tests for Acids).

The apparatus required are a small burette, two or three small porcelain evaporating basins, 5 c.c. and 10 c.c. pipettes, a glass filter, filter stand, and filter papers. The reagents which are usually required comprise a decinormal solution of caustic soda—*i.e.*, a solution of caustic soda so prepared that each c.c. corresponds to 0·00365 gramme hydrochloric acid—an alcoholic solution of phenolphthalein (2 per cent.); an alcoholic solution of phloro-glucin and vanillin (*Günzberg*); some ether; and a solution of carbolo-chloride of iron (Uffelmann's test for lactic acid). The latter is made at the time of using by the addition of a few drops of perchloride of iron solution to a 1 in 80 solution of carbolic acid.

Tests for Acids Present—A. *Total Acidity.*—The total amount of acidity present in the gastric contents (vomit, or fluid removed by syphon) may be estimated as follows:—Take 10 c.c. of the gastric fluid—filtered and diluted if necessary—add a few drops of the phenolphthalein solution, and then titrate from the burette containing the decinormal solution of caustic soda until the colourless fluid becomes tinged with pink. Read off the quantity of soda solution used—each c.c. used being equivalent to 0·00365 hydrochloric acid.

N.B.—This test would be correct were only hydrochloric acid present, which is not usually the case. When, however, there is *distinct* presence of hydrochloric acid in the gastric fluid, this implies the absence of any material quantity of organic acids which are products of decomposition—the hydrochloric acid being antiseptic. The above test gives a fair practical result, if lactic acid be tested for separately (*vide infra*).

B. *Free Hydrochloric Acid.*—For the detection of free hydrochloric acid in the gastric fluid, place a drop or two of the phloroglucin-vanillin solution upon a porcelain evaporating basin, and gently heat it over the flame until dried. Then add a drop of the gastric fluid, with a glass rod, to the edge of the dried film, and a *crimson* colour appears if mineral acid is present.

N.B.—The chief possible fallacy in this test is the presence of other acids; but these may be disregarded, practically, as they only interfere with the test if they are concentrated.

C. *Free and Combined Acid.*—To find the amounts of acid, free and combined, the methods recommended are all open to fallacy, or are too complicated for other than laboratory research. The simplest method is that recommended by Lockhart Gillespie, which consists of testing as above, A, for the total acidity, and then drying another 10 c.c. at 100° C. to test for the amount of acid present after evaporation. The evaporation may be conducted slowly over a steam pipe, or a porcelain evaporating basin may be floated in a pan of boiling water. After several hours, when evaporation to dryness is complete, the acidity may be estimated, as in A. The result shows the amount of combined acid ("proteid hydrochlorides") present, and this represents the amount of digestive work done; while the *difference* from the total acidity previously found gives the amount of free acid, and represents the potential energy of the gastric juice. In estimating the two conditions, the *diet* ingested, and the *time* which has elapsed since the taking of the meal to the withdrawal of the gastric contents by the syphon, must be considered. If the acidity after evaporation be not the same, and no free acid has been found by the qualitative test, B, the decrease is due to evaporation of volatile acids of the acetic and butyric series; but even if free hydrochloric acid has been found with test B, the decrease may still be due to *some* evaporation of volatile organic acid as well.

D. *Organic Acids.*—To test for the presence of *lactic acid*, apply Uffelmann's solution. The amethyst-blue colour is changed to a canary-yellow if lactic acid be present. Alcohol, sugars, and phosphates give this reaction, but not so quickly, and not in so marked a manner as with lactic acid. *Acetic acid* renders Uffelmann's solution *brownish* in colour. *Butyric acid* discharges the blue from it, leaving a dirty opalescent grey; while hydrochloric acid combined with proteid yields a tint very similar to that produced by acetic acid.

By shaking up a portion of the stomach contents with ether the organic acids may be removed and tested separately, but the amount of ether necessary involves the abstraction of *some* of the hydrochloric acid as well, and makes the method expensive.

Test Meals.

These are stated meals devised for the comparative estimation of the digestive powers in gastric cases. A single proteid or carbohydrate may be given according to symptoms. Ewald gives a dry well-baked roll with water or weak tea, and with such a meal the contents of the stomach may be withdrawn by the syphon, and tested, in about one hour. Some recommend a meal of "water-broth, semolina and flour-gruel, and meat," but the stomach contents should not be tested after this meal for four hours or longer. Meat and bread may be used, and, indeed, any light meal, simple in character, may be used, so long as the proportions of its constituents are known, and due regard given to the physiology of

digestion. The object of the test meal is to ascertain the digestive powers, by the application of the preceding section, or by a more extensive analysis if necessary (*vide* Lockhart Gillespie's *Manual of Stomach Methods*).

Estimation of Phosphates in Urine, expressed as Phosphoric Acid (P_2O_5).

Two to three grammes P_2O_5 (as phosphates) are excreted, normally, in the urine in twenty-four hours. In children the same proportion is excreted in relation to body-weight.

Reagents Required.—(1) Solution of P_2O_5, so prepared that 50 c.c. contain 0·1 gramme.

(2) Solution of acetic acid and acetate of soda.

(3) Solution of ferrocyanide of potassium (1 in 10).

(4) Solution of uranium nitrate, so prepared that 20 c.c. neutralise 0·1 gramme P_2O_5.

Method.—First prepare solution No. 3, as an indicator, by placing, with a glass rod, several rows of drops upon a white slab. Next, take 50 c.c. of solution No. 1, add 5 c.c. solution No. 2, place in a porcelain evaporating dish over a flame, and, while boiling and stirring, titrate from a burette containing a noted quantity of No. 4, until a drop removed from the dish gives a brown reaction with a drop of the indicator. If the uranium nitrate is properly prepared, this reaction will take place when exactly 20 c.c. have been used. If not, observe the exact quantity required to precipitate 0·1 gramme of the P_2O_5 solution (No. 1), as indicated by the brown reaction, and note the *corrected* figure, which is equivalent to 0·1 gramme P_2O_5. Having now tested the uranium nitrate solution, place 50 c.c. urine in a clean evaporating dish, add 5 c.c. solution No. 2, and, while stirring and boiling, titrate from the burette, testing from time to time by means of the drops of the indicator on the slab, reading off the quantity of No. 4 solution used on obtaining the brown reaction.

Example.—The solution of uranium nitrate having been tested, and 20 c.c. found to be the equivalent of 0·1 gramme P_2O_5, the reading of the burette containing solution No. 4 is 40 c.c. After titration, until a drop of the urine gives a faint brown colour with the indicator, the reading of the burette is 25·2—*i.e.*, 14·8 c.c. have been used. Then—

20 c.c. : 14·8 :: 0·1 P_2O_5 : P_2O_5 in 50 c.c. urine—*i.e.*, 0·074.

If 1500 c.c. of urine have been collected in the twenty-four hours, then $0{\cdot}074 \times 30 = 2{\cdot}220$ grammes P_2O_5 excreted in the twenty-four hours.

Comparative Estimation of Urine Acidity.

Although subject to variations during the day, when the secretion may even be alkaline, the average normal urine is acid in reaction.

The total acidity in the twenty-four hours is normally equivalent to about 2 grammes (30 grains) of oxalic acid—the acidity being due to acid salts (phosphates and urates). The acidity of the urine is increased with a large nitrogenous diet; and in lithæmic conditions, fevers, scurvy, and diabetes. It is diminished with a vegetable diet; and in cases of dyspepsia, dilated stomach, neurasthenia, hypochondriasis, and in anæmia (simple, pernicious, and chlorotic) it is frequently alkaline—such cases having usually deposits of calcic phosphates in the urine. The urine may also be alkaline from microbic infection (*Micrococcus ureæ*)—generally by catheter contamination, but sometimes from an abscess opening into the urinary tract, &c.

To estimate the acidity of urine, place in a flask 50 c.c. urine and titrate from the burette with decinormal caustic soda solution, shaking the flask well with every few drops until a drop from the flask gives a slight alkaline reaction on litmus paper. The acidity may be expressed by the amount of decinormal soda solution used in 50 c.c. urine; or it may be expressed as equivalent to oxalic acid —each c.c. of the decinormal solution of soda being equal to 0·0063 gramme of oxalic acid.

Acetonuria and Diaceturia.

Acetone, and aceto-acetic acid or diacetic acid are sometimes found in the urine in acute or chronic gastric catarrh, gastric ulcer, dilatation of the stomach, enteritis, &c.

Acetone is sometimes found alone, and then may be detected by the smell; but more usually both bodies are found together.

The readiest test, clinically, for *acetone* is to treat the urine with a few drops of a freshly made concentrated solution of sodium nitroprusside, also adding a solution of caustic soda. The fluid becomes red, but this disappears; and, on adding a little acetic acid, a purple or violet-red colour is produced, if acetone is present. For the detection of diacetic acid, the addition of perchloride of iron produces a claret-red coloured reaction.

The symptoms of the mild forms of acetonuria and diaceturia are epigastric pains, vomiting, giddiness, and headache; while the severe forms resemble cases of diabetic coma.

Testing Diabetic Breads for Sugar and Starch.

A weak solution of iodine dropped upon the biscuit or bread will detect the presence of starch. To detect sugar, boil the bread with dilute sulphuric acid, neutralise with caustic potash, and test with Fehling's solution.

Ehrlich's Diazo Reaction.

Reagents.—(1) Saturated solution of sulphanilic acid in dilute hydrochloric acid (1 in 20). (2) A half per cent. aqueous solution of sodium nitrite. To the urine in a test tube add about 40 c.c. of solution No. 1, and about 1 c.c. of solution No. 2; shake well; run a few drops liquor ammonia down the side of the test tube, in the same manner as in the cold nitric acid test for albumen. A deep brown-red ring appears at the junction of the fluids, and if again shaken the mass appears red, and the foam rose-coloured. The reaction is seen in *many* febrile conditions—*e.g.*, enteric fever, scarlet fever, measles, and pneumonia.

Ziehl's Modification of Ehrlich's Method of Staining Tubercle Bacilli

requires the following reagents:—(1) Ziehl's solution of carbol-fuchsine (10 c.c. of a saturated alcoholic solution of fuchsine added to 90 c.c. of a 5 per cent. watery solution of carbolic acid); (2) sulphuric acid (25 per cent. solution); and (3) methylene blue (concentrated aqueous solution).

Sero-diagnosis of Enteric Fever (*Widal's Test*).

A drop of blood or serum to be examined is mixed with nine parts of neutral bouillon. One drop of a twenty-four-hours-old culture of typhoid bacillus is mixed with the above on a glass slide, and then a cover-glass is placed over it. Examine with a low power. Within one or two minutes, if the blood be from a case of enteric fever in the second to the fifth week of the illness, the rapid movement of the bacilli (observed in normal blood) becomes slow and motionless. They form clumps ("agglomeration phenomenon"). In a few exceptional cases the reaction is not distinct until after one or even two hours. The reaction has been noticed as early as the fourth day of typhoid.

INDEX.

Bell & Bain, Limited, Printers, Glasgow.