

INTERMITTENT FASTS IN THE CORRECTION AND CONTROL OF INTRACTABLE OBESITY

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Obesity is a major clinical and public health problem. In this country, more than one in 20 males and one in nine females of 20 years of age and older are at least 20% above the average weights.¹ Levy et al.² found sustained hypertension two and one-half times as frequently in army officers who were overweight as in those not overweight, and Master et al.³ found that blood pressures in the overweight were consistently higher than in middle weight and thin people. Also, the Framingham Study⁴ revealed that those who were appreciably overweight showed twice as many new cases of arteriosclerotic heart disease as those who weighed less than the average.

Obesity preceded the onset of diabetes in 83% of 1500 cases collected by Travie, quoted by Joslin et al.⁵ Diabetic subjects, as insured risks, showed that weight 5 to 14% in excess of normal was associated with a mortality of one and one-half times that of those with average weights and eight and one-third times in those whose weights exceeded normal by 25% or more.⁶

Clinical and insurance experience indicate that benefits accrue with correction of overweight.⁷

Bloom⁸ found that short periods of fasting as an introduction to the treatment of obesity were effective and were well tolerated. His patients experienced a sense of well being while reducing an average of more than 2.5 lbs. per day. It was on the basis of Bloom's experience and that of Benedict,⁹ Cannon¹⁰ and Keys¹¹ that we have employed total fasts of 1 to 15 days as a means of reducing obese diabetic and non-diabetic patients. Subsequently one- and two-day fasts were introduced at varying intervals to effect continued reduction in weight and to overcome tendencies to gain weight. The subjects have been selected from those who have been unable to reduce by usual measures; i.e., low calorie diets—prescribed but presumably not adhered to—anorexic drugs, exercise, psychiatric guidance and bizarre diets. Most of these patients had abandoned hope that they could reduce on diets that would reduce normal individuals. Each patient was hospitalized for clinical evaluation and the initial fast. Pregnancy, infections, chronic and acute hepatic disease, recent myocardial infar-

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tions, uncontrolled labile diabetes and peptic ulcers were considered contraindications to the total fast.

Prior to the fast, a glucose tolerance test was done and, because of a high incidence of disease of the gallbladder, cholecystograms are being done routinely. Other studies have included multiple blood sugar, serum and urine ketone determinations, CO₂ combining power, electrolytes, lipids and fibrinolytic activities and steroid and sodium chloride excretions.

The effects of total fasts have been observed in 107 obese subjects seen in our public wards and as private patients of my own and other Staff members. Water was allowed as desired, also weak tea or coffee and flavored beverages of no food value. Based on the experience that vitamin deficits occurred in prisoners of war during starvation and that these deficits became apparent after a liberal nutritional intake was resumed, vitamins were prescribed in therapeutic amounts as a prophylactic measure.*

Subjects under 18 years of age were not subjected to continuous fasts of more than seven days duration and, in most of these cases, the fast was restricted to four or five days. For those over 18, the fast periods were from five to 14 days. Food was resumed one day before discharge—usually 1500 to 2300 calories. A one-day fast per week was utilized to achieve progressive reduction in weight. Physical activity was restricted to a minimum during all fast periods. Weakness was encountered when this rule was violated.

ILLUSTRATIVE CASE REPORTS

V.K. (A55039): A white female, aged 16 years, weighing 172½ lbs., height of 60½", gave a family history of diabetes but she was not known to have diabetes prior to admission, in December of 1961, for the correction of obesity.

Physical findings, except for obesity and a mildly morose state, were not remarkable.

A glucose tolerance test was indicative of a mild diabetes; the blood sugar (Somogyi-Nelson Method) values, in mg./100 ml., were: Fasting—76; one half hour—147; one hour—130; one and a half hours—155; two hours—137 and three hours—103. There was no glycosuria.

A seven-day fast resulted in a decrease of 13.5 lbs. A hyperketonemia

* A multiple vitamin capsule (Theragran) was given once or twice daily. Each capsule contained: Vitamin A—25,000 USP units; Vitamin D—1,000 USP units; thiamin mononitrate—10 mg.; riboflavin—10 mg.; niacinamide—100 mg.; ascorbic acid—200 mg.; Vitamin B₁₂ activity concentrate—5 mcg.; pyridoxine hydrochloride—5 mg. and d-calcium pantothenate—20 mg.

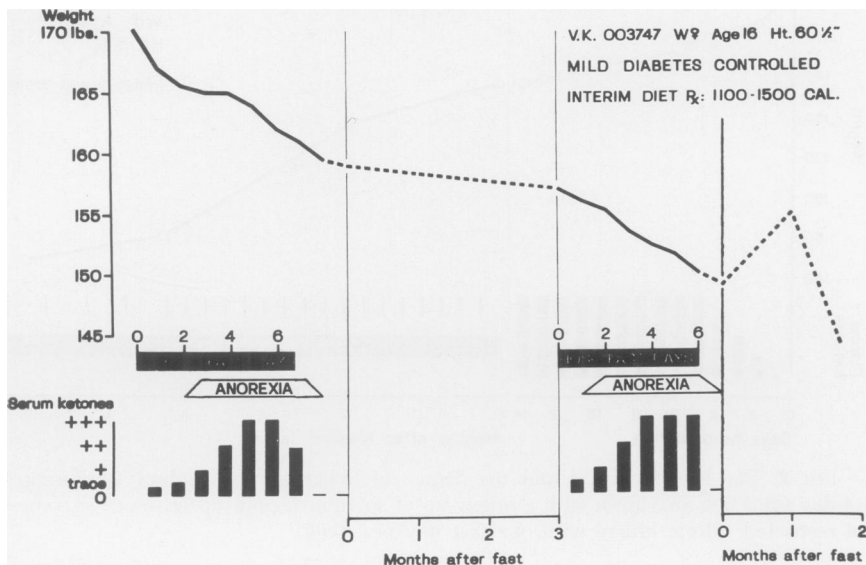


FIG. 1. The reduction in weight and the association of anorexia and hyperketonemia during two periods of total fasting are depicted.

and an associated anorexia were noted on the second day and remained until the end of the fast (Fig. 1).

The regimen, on discharge, consisted of a diet of 1500 calories (Protein—90, Fat—47, Carbohydrates—180 gm.) with supplementary vitamin therapy and a single day of fast each week.

Re-admitted in April of 1962, V.K. weighed 158 lbs. During a seven-day fast, she reduced eight pounds. Hyperketonemia developed with concomitant anorexia. On discharge, a diet of 1500 calories was prescribed with an occasional day of fast to prevent or correct increases in weight. Following an initial gain in weight at home, the reduction was resumed (Figure 1). This patient's first admission has been reported elsewhere.¹²

M.F. (002725): White male, aged 36, height—5'7", seen in March 1960, gave a history of having gained from 140 lbs. in 1953 to 185 lbs. in 1960 at which time his blood pressure was 128 systolic and 72 mm. Hg diastolic.

His weight increased to 212 lbs. by October 1961, and his blood pressure had risen to 164/104; otherwise, he was in good health. By February of 1962, he weighed 214 lbs.

A total fast regimen, from March 13–28 of this year, resulted in a reduction to 188 lbs. (Fig. 2). His diet on discharge provided 1500 calories

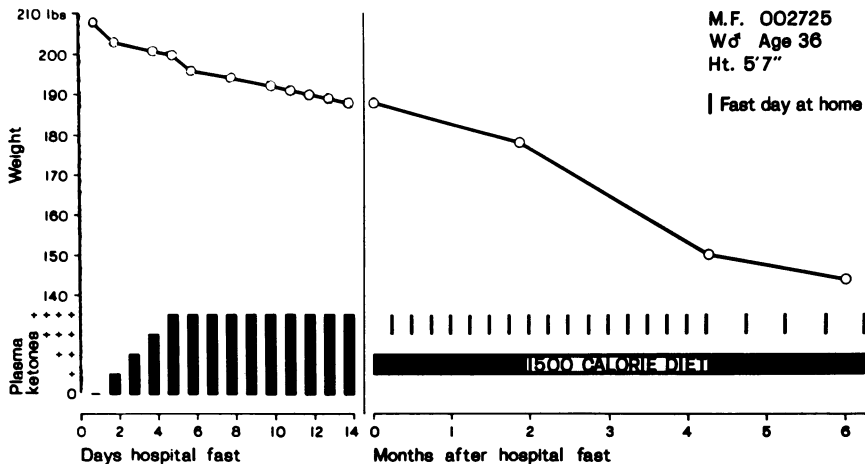


FIG. 2. The loss of weight and the degree of hyperketonemia observed during a 14-day total fast are shown with a follow-up of six months indicating the effectiveness of restricted caloric intake with one fast day per week.

with temporary inclusion of one fast day per week. In August of 1962, his weight was 150 lbs. and blood pressure was 116 systolic and 80 diastolic.

W.H. (001766): A white male, aged 53 years, was seen in March 1962 for the control of hypertension and obesity. He was taking hydrochlorothiazide, hydralazine and mecamlamine, and the blood pressure had decreased from 210 systolic and 130 diastolic to 184/106; Grade II (Keith Wagner) retinal changes were present. His weight was 325 lbs. and height was 70½". During a 14-day fast, all drugs were discontinued. His weight decreased to 301 lbs. (Fig. 3) and in May, it was 292 and his blood pressure was 136/90—without medication. By September 1962, his weight was 244 lbs. and blood pressure—130/75. The serum cholesterol had decreased from 325 to 301 mg/100 ml.

RESULTS

Two patients abandoned the fast, one after three and the other after four days. We concluded that one foresaw the withdrawal of the attentions of her pathologically solicitous husband if her obesity (305 lbs.) were corrected; and the other—weighing 412 pounds and who was responding exceedingly well—foresaw the necessity of assuming the responsibilities of a normal adult if he were restored to normal. As it was, he was fed, housed and had every wish attended to by a devoted family.

Ketonuria usually occurred on the first or second day of the fast and

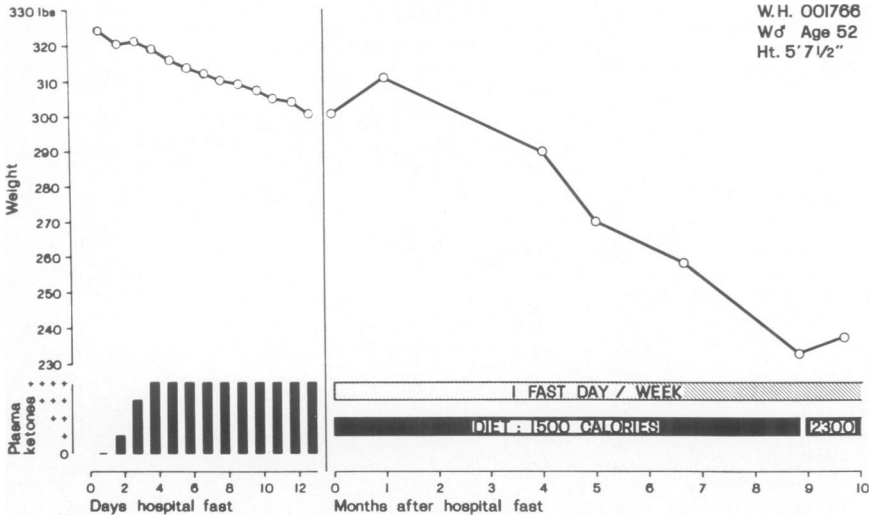


FIG. 3. The hyperketonemia and reduction of weight during the total fast is indicated. The continued favorable effect of moderately restricted caloric intake with one total fast day per week for ten months subsequent to the total fast of 14 days is shown.

hyperketonemia was detectable* on the second day and increased as the fast progressed, as illustrated in Figure 1 and Table 1. More complete studies of this aspect have been reported by Bloom.¹³ Though the total fat transport must have been greatly increased, the total serum lipids remained within normal limits. The serum cholesterol increased moderately in some and decreased in others. Previously undetected diabetes and "pre-diabetes" were discovered in several patients. The CO_2 combining power, electrolytes, and fibrinolytic activities and steroid excretion remained within normal limits. The loss of NaCl in the urine exceeded normal in the early days of the fast, but hyponatremia was not detected. This conforms with the observations of Bloom and Mitchell.¹⁴

Mild degrees of weakness, especially in those who were fairly active, were recorded but in none did this necessitate interrupting the fast. Headaches and light headedness were complained of in a few instances. Transient waves of nausea in a mild form, except in one case in which vomiting occurred, were reported by approximately a third of these subjects. A prompt, moderate gain in weight attributed to fluid retention invariably ensued when food was resumed.

The favorable effects were: Loss in weight varying from 1.5 to as much as 5 pounds in one day—the average loss was between 2 and 2.7 pounds

* Modified Rothera (nitroprusside) test for ketones.

TABLE 1
Ketonemia, Ketonuria and Fasting

1962	Blood			Urine		
	Total ketones	Aceto-acetic acid	Oxybutyric acid	Total ketones	Aceto-acetic acid and acetone	Oxybutyric acid
Normal	0.8-5.5	<i>mg/100 ml</i>		<i>mg/24 hr.</i>		
		0.3-2	0.5-3.5		3-5	20-30
May 17	2.1*					
“ 18	2.3†	1.6	0.7	24	14	10
“ 19	4.9†	2.5	2.4	510	350	160
“ 20	6.2†	3.7	2.5	1850	962	888
“ 21	10.1†	6.4	3.7	2860	1065	1785

* Serum.

† Whole blood.

Patient: Mrs. N.C. (003277), Age—55, Height—67 $\frac{3}{4}$ ", Weight—208-189 $\frac{1}{2}$ lb.

per day; the sense of well being and cheerfulness was surprisingly constant; anorexia was striking, notably after the first day of the fast—but, in many, hunger was not a complaint at any time. Several patients expressed a desire to continue the fast beyond 14 days; there was a close relationship between hyperketonemia and loss of appetite in every case; in three cases of previously resistant psoriasis this disorder subsided during the reduction program; in each instance of essential hypertension the blood pressure decreased to normal during the fast. All cases of hypertension were relatively mild.

The follow-up, covering periods varying from one to thirty two months, are indicated in Table 2. Though 40% have regained their former weights, or more, 17% have continued to reduce and 43% have maintained the initial reduction. This latter group, it would seem, are promising candidates for a repetition of the total fast.

SUMMARY AND CONCLUSIONS

Total fasts, 4 to 14 days, provide an effective means of reducing intractably obese patients. Subsequent one- or two-day fasts, at varying intervals, have served to continue the reduction and permit a more liberal diet on a day to day basis.

Total fasts have been better tolerated than diets low in calories, presumably because of the anorexic effect associated with the former and not the latter.

The anorexia during total abstinence from food is associated with, and is believed to be due to, the hyperketonemia provoked by the fast.

TABLE 2

*Weights Subsequent to Total Fast—107 Patients (Ward and Private)
One—Thirty-two months (October 1, 1962)*

Regained to previous weight, or more	42 (40%)
Reduction maintained	47 (43%)
Continued to lose	18 (17%)
	107 (100%)

Sixty percent of 107 patients who reduced weight by short periods of total fasting either maintained their reduced state (43%) or continued to lose (17%); whereas, 40% regained or exceeded their former weights.

REFERENCES

1. Overweight: Its prevention and Significance. Statistical Bulletin, Metropolitan Life Insurance Co., p. 6, 1960.
2. LEVY, R. L.; WHITE, P. D.; STROUD, W. D. AND HILLMAN, C. C. Overweight: Its Prognostic Significance in Relation to Hypertension and Cardiovascular Diseases, *J.A.M.A.*, 131: 951, 1946.
3. MASTER, A. M. AND LASSER, R. P. Relation of Blood Pressure to Weight and Body Build in Apparently Healthy Subjects, 65-106 years of age. *Amer. Jour. Med. Sc.*, 235: 278, 1958.
4. DAWBER, T. R.; MOORE, F. R. AND MANN, G. V. Coronary Heart Disease in the Framingham Study. *Amer. Jour. Publ. Health (Suppl.)* 47: 4, 1957.
5. JOSLIN, E. P.; ROOT, H. F.; WHITE, P. AND MARBLE, A. The Treatment of Diabetes Mellitus. Lea & Febiger, Philadelphia, Page 65, 1959.
6. DUBLIN, L. I. AND MARKS, H. H. *Human Biology*, 2: 159, 1930.
7. Statistical Bulletin, Metropolitan Life Insurance Co., 43: 1, 1962.
8. BLOOM, W. L. Fasting as an Introduction to the Treatment of Obesity. *Metabolism* 8 (No. 3): 214, 1959.
9. BENEDICT, F. G. A Study of Prolonged Fasting. *Carnegie Inst. Publ.*, No. 203, 27, 42, 182-183, 1915.
10. CANNON, W. B. Bodily Changes in Pain, Hunger, Fear and Rage. (2nd Ed.) Charles T. Bradford Co., Boston, pp. 273-274, 1953.
11. KEYS, A.; BROŽEK, J.; HENSCHEL, A.; MICKELSEN, O. AND TAYLOR, H. L. Human Starvation. *The University of Minnesota Press. Vol. II*, Page 820, 1950.
12. DUNCAN, G. G.; JENSON, W. K.; FRASER, R. I. AND CRISTOFORI, F. C. Correction and Control of Intractable Obesity. *J.A.M.A.*, 181: 309, 1962.
13. BLOOM, W. L. Fasting Ketosis in Obese Men and Women. *Jour. Lab. and Clin. Med.* 59: 605, 1962.
14. BLOOM, W. L. AND MITCHELL, WM., JR. Salt Excretion of Fasting Patients. *Arch. Int. Med.*, 106: 321, 1960.

DISCUSSION

DR. WALTER L. PALMER (Chicago): It might interest the Association to know that in the past I have used essentially this procedure in three patients. The regimen was complete starvation except for black coffee. My first patient smoked cigars and so the prescription became black coffee and cigars. This gentleman underwent treatment on several occasions, not for two weeks but for a month each time, with no ill effects

and with an average loss of weight of two pounds per day or sixty pounds in the course of a month. It is obvious, of course, that such rapid reductions in weight are accomplished by means of large losses of water. Our difficulty with this patient was that he would then leave the hospital to regain his sixty pounds or better. He would then come in, starve, and reduce to three hundred pounds, considered by him to be starved weight. After leaving the hospital he would slowly regain 60 to 100 pounds and again find himself in cardiac failure. Then we would start over again. He finally died in cardiac failure.

I have come to the conclusion that while patients can tolerate such complete starvation with little difficulty for one month, the program of a two-week starvation period is better because the real problem, as Dr. Duncan indicated, is to keep them from regaining their weight. I therefore think that one can control them better with repeated short courses of starvation and some attempt to maintain their diet in between rather than the longer period of starvation which the patient then looks upon as a cure and goes his way.

One point with respect to the patient with a peptic ulcer, I think I would not consider peptic ulcer to be a contra-indication to starvation because many patients with peptic ulcer do very well indeed on starvation. If they do not do well, there are other methods of dealing with the ulcer.

DR. THOMAS C. CHALMERS (Boston): This is an extremely interesting report which has implications all the way from biochemistry to psychiatry. However, I would like to express a word of caution which comes from observations about previous methods of therapy for obesity, of which there are legion, and most of which have seemed so very successful when first introduced and then have not stood the test of time, as the expression goes.

There are three possible reasons for the apparent effectiveness of a new agent in a preliminary trial. One has to do with the selection of patients for the new regimen, second has to do with any other form of therapy which may accompany the one under trial and, third has to do with the regimen itself. It is terribly important to keep the first two in mind in drawing conclusions about the effectiveness of the third, and yet it is impossible to measure the importance of the first two unless a well controlled study is carried out.

I know that it may be important for the best possible dose to be decided on before the controlled study is undertaken. In this instance, it was necessary to determine the number of days of fast that seemed to be most suitable and the frequency of intermittent fasts thereafter.

However, before general adoption of this method of therapy and possible later discouragement resulting from failures which cannot be understood because of differences in the selection of patients or of other types of therapy administered at the same time, a controlled trial in which patients are assigned to the new and conventional therapy groups at random should be carried out.

I would also like to pursue the same question with regard to Dr. Conn's remarks in connection with his diabetic children. I believe that this same procedure should also apply there.

DR. THORNTON SCOTT (Lexington): Some investigators have described marked swings upward in serum protein and cholesterol, with marked reduction in weight attendant on starvation and then the resumption of weight gain. I wonder if you have any observation along this line?

DR. GEORGE F. CAHILL, JR. (Boston): I merely want to make one comment here. We have to explain to these obese people how weight loss occurs. Most of them become tremendously impressed with the eight or ten pounds lost in the first week or

two, and then become extremely discouraged as this weight loss becomes less dramatic. In other words, they should be informed that the initial 2-3 pound weight loss per day, as shown by Dr. Duncan, is mainly water with a little salt, and that they should expect at best only a loss of one-half pound of fat tissue per day, unless they are doing almost continuous vigorous exercise.

DR. FRANCIS WOOD (Philadelphia): I think that what you have demonstrated is something we have all learned about life in general—that abstinence is very much easier to practice than temperance.

DR. DUNCAN (Closing): I want to thank the discussers for their comments.

Dr. Palmer, while we have considered peptic ulcers a contraindication to fasting, we have been probing this problem and successfully as you suggest. Since reading an abstract in which a Russian physician advocated fasting as beneficial in cases of peptic ulcer, we have subjected two patients having duodenal ulcers to the "fast" regimen with salutary results.

As for caution, we are fully aware of this need. I fear, however, that this consideration is sometimes violated by others; e.g., a recent letter from a colleague indicated that his pregnant wife had successfully tolerated three weeks of a complete fast and with presumably good effects. We prefer to wait until the puerperium is over and even then, restrict fasting to the non-lactating mother. Also, we deprecate total fasts of a day or two for the mild or even moderate obese for whom less severe measures will suffice. However once patients have been subjected to a total fast, invariably they prefer it to low calorie diets. They will rarely go back to the continuous low diet, when a fast one day per week permits them to consume pretty much what they wish on the other six days.

With regard to the cholesterol, there was no constant behavior as the result of fasting. In some it decreased, but about as often it increased.

I realize that it isn't what is accomplished in the initial weeks of therapy that counts. It is the weight and state of health that these patients are experiencing one, two, five and ten years from now that will indicate the value of the plan of therapy I have presented. We get bi-monthly records of the weights of those patients who come from long distances and, of course, we see those nearby. This expression of interest on our part has encouraged patients. So far we have lost contact with only one patient in one hundred and seven.

We warn our patients, when they are embarking on a complete fast, that they are going to lose two and a half pounds a day in all probability but that they must remember that, if they are in for a fourteen day fast and they lose thirty-two pounds, they will gain back six or eight pounds in the first few days after food is resumed. This is a gain in body water content. They are prepared for what would otherwise be a disappointment. They are not to be disappointed at a three-pound loss of weight per week subsequently. I discourage the patient being disappointed with that. That is more than one hundred fifty pounds a year loss and, of course, for most of these subjects this is much more than they will need to lose. We must learn to think of success in terms of six months, a year or even two years according to the degree of obesity. Severe grades of obesity represent a serious disease, just as lethal as tuberculosis used to be, and yet it shocked no one to embark on a six month's, or more often, a year's plan of therapy for the tuberculous patient.

The instructions to the patient are of great importance. Also, we have noticed an improvement in the past few months in the ability of these patients to keep their weight under control by observing one fast day per week. This allows them to be more liberal with their diets on the other days. I cannot overemphasize the fact that they prefer this to perpetual daily denial with no alternative.