

Two Weight-Reduction Programs Among Southwestern Indians

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OBESITY is extremely prevalent among most American Indians. More than half of those over 15 years old from southwestern desert tribes—65 percent of women and 39 percent of men—exceed their ideal weights (1) by more than 25 percent. Since obesity is also considered a widespread health hazard in the general population, numerous meth-

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ods of medically supervised weight reduction have been proposed. None has been highly successful, although most evaluations have extended for only a few months to a few years from the start of therapy.

This report compares the long-term results of two weight-reduction programs for overweight patients at the Phoenix Indian Medical Center. One group received conventional low-calorie therapy, and the other received an initial fasting program with subsequent conventional therapy.

The Phoenix Indian Medical Center is a referral hospital for more than 55,000 southwestern Indians from Arizona, California, Nevada, and Utah. It also is the primary medical facility for Indians from nearby reservations or communities. The tribal distribution of the patients at the center is Pima 35 percent, Apache 21 percent, Navajo 10 percent, Papago 9 percent, Hopi

6 percent, other southwestern tribes 16 percent, and nonsouthwestern Indians 3 percent.

Methods

Patients attending the diabetic or medical clinics of the center during 1963–68 who exceeded 125 percent of their ideal weights were offered an in-patient, weight-reduction program consisting of medically supervised fasting in a minimal-care unit for variable periods. Most of these patients entered the program during the early part of the investigation. The minimum study period was 18 months, and the maximum was 90 months. Selection was based on acceptance by the patients and availability of hospital space.

The duration of starvation was individualized. Although most of the patients in the fasting program (FP) participated for 2 or 3 weeks, a few fasted longer. Some interrupted the program



A typical Pima family group, illustrating the early onset and generality of obesity

briefly with low-calorie meals, and a small number underwent repeated fasts. Following starvation, the patients were placed on conventional low-calorie therapy.

Most of the patients in the conventional management (CM) program were given dietary instructions for 1,500 calories a day or less. Anorectogenic agents were seldom prescribed; when given, they were generally used only for brief periods.

The patients were weighed, wearing their street clothes, at each clinic visit. Weights recorded during pregnancy, fluid accumulation, or debility, and, for the FP group, during fasting

and the following 2 months, were excluded from the evaluation.

Patients were matched for the FP and CM study groups in order to evaluate the relationship of sex, age, initial weight, diabetic status, and treatment program to the long-term results. Criteria for the diagnosis of diabetes mellitus were those of most authorities, as described in a previous publication (2). The data were analyzed by the paired *t* test.

Results

Sufficient long-term information for this comparative study was available for 51 (12 men

and 39 women) of the 71 patients who fasted, and they were matched with 51 CM patients. The average followup period for the CM group (71.5 months) was 15 months longer than for the FP group (56.5 months). The diabetic patients had a longer mean evaluation (FP 65.2 months, CM 75.2 months) than the nondiabetics (FP 44.2 months, CM 66.3 months). The mean number of formal instructions per patient for diets of 1,500 calories or less was slightly more for the FP group (2.2) than for the CM group (1.6).

The two study groups were statistically similar in age and

sex and identical in number of diabetics. However, since most of the extremely obese patients attending the clinics elected the FP, few patients of comparable weight were available for matching in the CM group. There were only three CM patients. In contrast to the 20 FP patients, who weighed 250 pounds or more. To exclude the influence of weight variations, data were compared for the 31 FP and 48 CM patients whose initial weights were less than 250 pounds, as well as for the 32 pairs whose disparity of initial matched weights was less than 10 percent (table 1). In both evaluations of patients with similar beginning weights, the final mean weights remained almost unchanged for the CM group but were significantly less for the FP group.

In table 2, the long-term weight changes are compared in three separate initial weight categories. The CM differences are insignificant in each weight group. However, the FP percentage of weight loss was disproportionately greater for the highest (11.5 percent) than for the intermediate (7.2 percent) or the lowest (4.8 percent) weight category.

The yearly changes of mean weights are shown in figure 1. For each of the 7 years a much larger percentage of FP than CM patients weighed at least 5 percent less than initially. The long-term weight decrease was significantly greater for the 60 diabetics (5.9 percent) than for the 42 nondiabetics (2.6 percent). During the study, a progressively larger percentage of the diabetic patients weighed at least 5 percent less than originally, while the pattern for the nondiabetics was more variable (fig. 2).

As shown in table 3, a signifi-

cantly larger proportionate weight loss ($P < 0.05$) occurred in the intermediate age group (30-49 years) than among the younger or older age groups. Additionally, about three-fourths of the age group 30-49 years had a long-

term weight reduction compared with about one-half of the younger and older age groups (table 4).

Of the 51 FP patients, 42 attained long-term weight losses, while only 26 of the 51 CM

Table 1. Comparison between the fasting and conventional management programs of long-term weight changes among patients with similar initial weights

Program	Number patients	Mean weight (pounds)		Percent change
		Initial	Final	
Initial weight \leq 249 pounds				
Fasting.....	31	212.7 \pm 33.4	197.1 \pm 31.9	¹ -7.3
Conventional.....	48	208.1 \pm 29.7	208.6 \pm 30.0	+0.2
Matched pairs ²				
Fasting.....	32	220.2 \pm 32.9	199.8 \pm 32.0	¹ -9.3
Conventional.....	32	218.6 \pm 31.7	216.5 \pm 30.8	-0.9

¹ $P < 0.05$; all other values not significant at 95 percent confidence level.

² < 10 percent initial weight disparity.

Table 2. Comparison of long-term proportionate weight changes in the fasting and conventional management programs in relation to initial weights of patients

Initial weight (pounds) and program	Number patients	Mean weight (pounds)		Percent change
		Initial	Final	
\geq 250:				
Fasting.....	20	272.3 \pm 16.5	241.0 \pm 30.2	¹ -11.5
Conventional.....	3	281.3 \pm 27.1	289.7 \pm 23.7	+3.0
200-249:				
Fasting.....	24	222.4 \pm 12.9	206.3 \pm 25.1	¹ -7.2
Conventional.....	33	220.4 \pm 12.5	220.8 \pm 18.8	+0.2
\leq 199:				
Fasting.....	7	183.1 \pm 11.1	174.3 \pm 15.7	-4.8
Conventional.....	15	181.1 \pm 9.9	181.6 \pm 10.9	+0.3

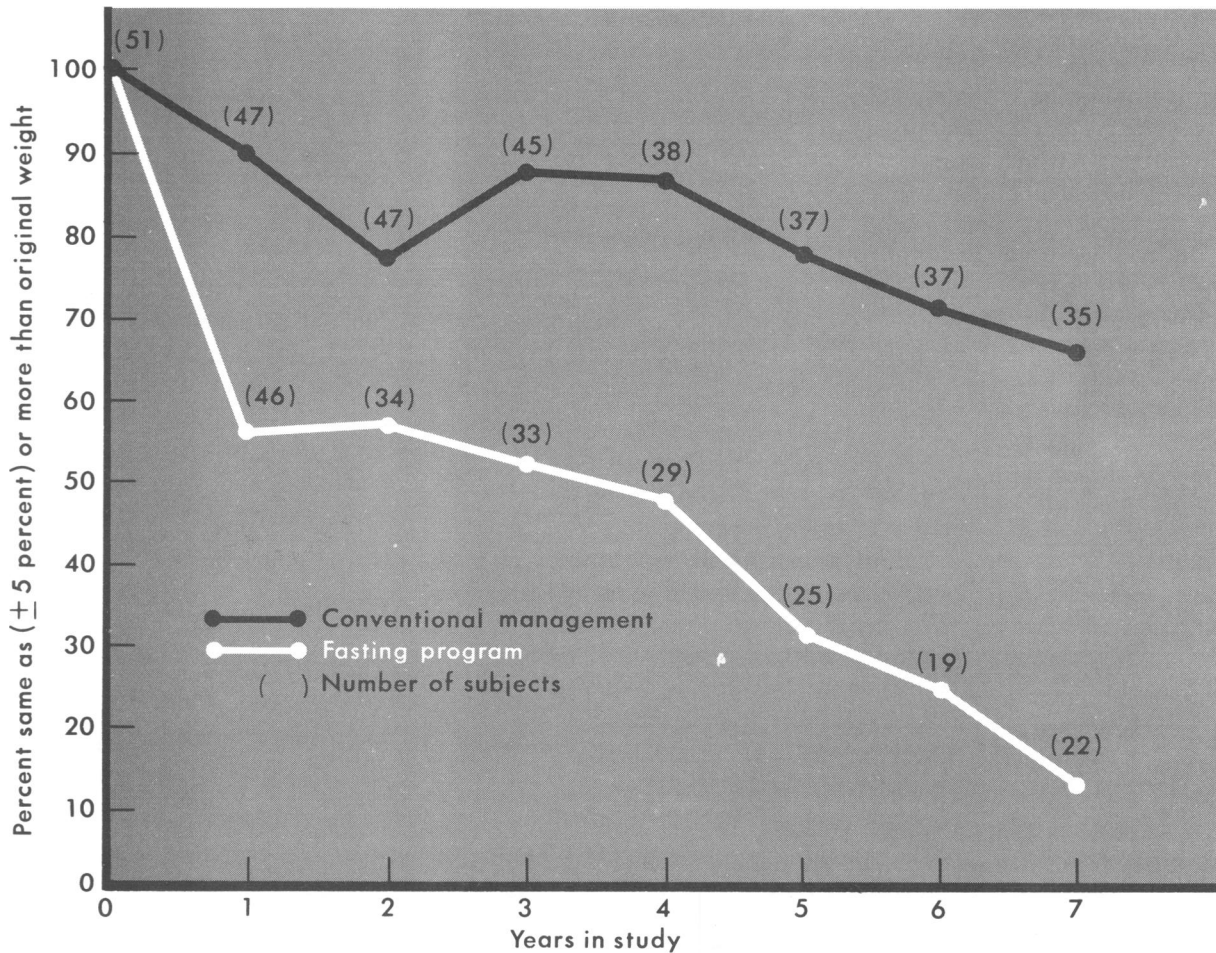
¹ $P < 0.05$; all other values not significant at 95 percent confidence level.

Table 3. Relationship of age to long-term weight change in the reduction programs

Age group (years)	Number patients	Mean weight (pounds)		Percent change
		Initial	Final	
\leq 29.....	19	222.2 \pm 33.1	226.0 \pm 35.7	+1.7
30-49.....	67	227.3 \pm 32.5	212.6 \pm 35.2	¹ -6.5
\geq 50.....	16	213.9 \pm 35.7	206.0 \pm 25.2	-3.7
All ages.....	102	224.2 \pm 32.9	212.9 \pm 37.1	¹ -5.0

¹ $P < 0.05$; other values not significant at 95 percent confidence level.

Figure 1. Yearly comparison of the proportionate weight change between fasting program and conventional management groups



patients achieved this result. Twenty pounds or more were gained by nine of the CM patients but only by two of the FP patients. In contrast, 23 FP and nine CM patients had lost 20 pounds or more. Nine FP patients sustained weight reductions of more than 45 pounds; one of these patients had lost 91 pounds and another, 83 pounds.

Although 41 percent of the FP patients attained a long-term reduction of 10 percent or greater, this result occurred among only 14 percent of the CM patients (fig. 3). One FP patient sustained a 40 percent weight reduction. A long-term

gain of 10 percent or more occurred in 20 percent of the CM group but in only 4 percent of the FP group.

Discussion

In 1959 Bloom (3) reported that short periods of fasting at the start of treatment for obesity were effective and well tolerated. The risks are small if adequate selection criteria (4,5) are followed. Few clinicians used therapeutic starvation until Duncan and associates (6,7) published their dramatic results in 1962 and 1963. Thereafter, enthusiastic endorsement (4,5,8,9) was soon followed by reports that

fasting removed less adipose tissue than protein (10,11). A recent study (12), however, found that man tolerates prolonged starvation by markedly attenuating protein catabolism, while deriving 95 percent of the caloric requirement from fat tissue. Although some limited brief followup studies of persons who had fasted were unfavorable (13,14), no long-term evaluations were reported.

In a 1959 review of nine studies of the conventional management program for obesity (15), 27 percent of the 1,468 subjects achieved an initial weight loss of 20 pounds or more. How-

ever, followup of 299 overweight persons in the evaluations by Stunkard and McLaren-Hume (15) and by Glennon (16) revealed that only 10 percent maintained a weight loss of 20 pounds or more beyond 1 year. Thus, conventional management of obesity attains limited success with the initial reduction and even less for the subsequent maintenance.

In the present investigation, 18 percent of the CM patients and 45 percent of the FP group had a weight loss of 20 pounds or more at an average followup period of 64 months. Therefore, the long-term results of conventional management among south-

Table 4. Percentage of patients with long-term gain or loss of weight in each age group

Age group (years)	Number Patients	Long-term gain ¹		Long-term loss	
		Number	Percent	Number	Percent
≤29.....	19	9	47.4	10	52.6
30-49.....	67	17	25.4	50	74.6
≥50.....	16	8	50.0	8	50.0
All ages.....	102	34	33.3	68	66.7

¹ Includes 1 patient with weight unchanged.

western Indians were similar to those reported for other overweight groups, but the FP patients achieved a sustained weight loss of 20 pounds or greater about two and a half times as often as CM patients. Furthermore, the

extent of long-term weight reduction was much greater for the FP patients than the CM patients.

Most of the FP patients—37 of the 51—underwent only one initial fast, which was usually concluded and its effects dissi-

Figure 2. Yearly comparison of proportionate weight changes in the diabetic and nondiabetic patients in the weight-reduction programs

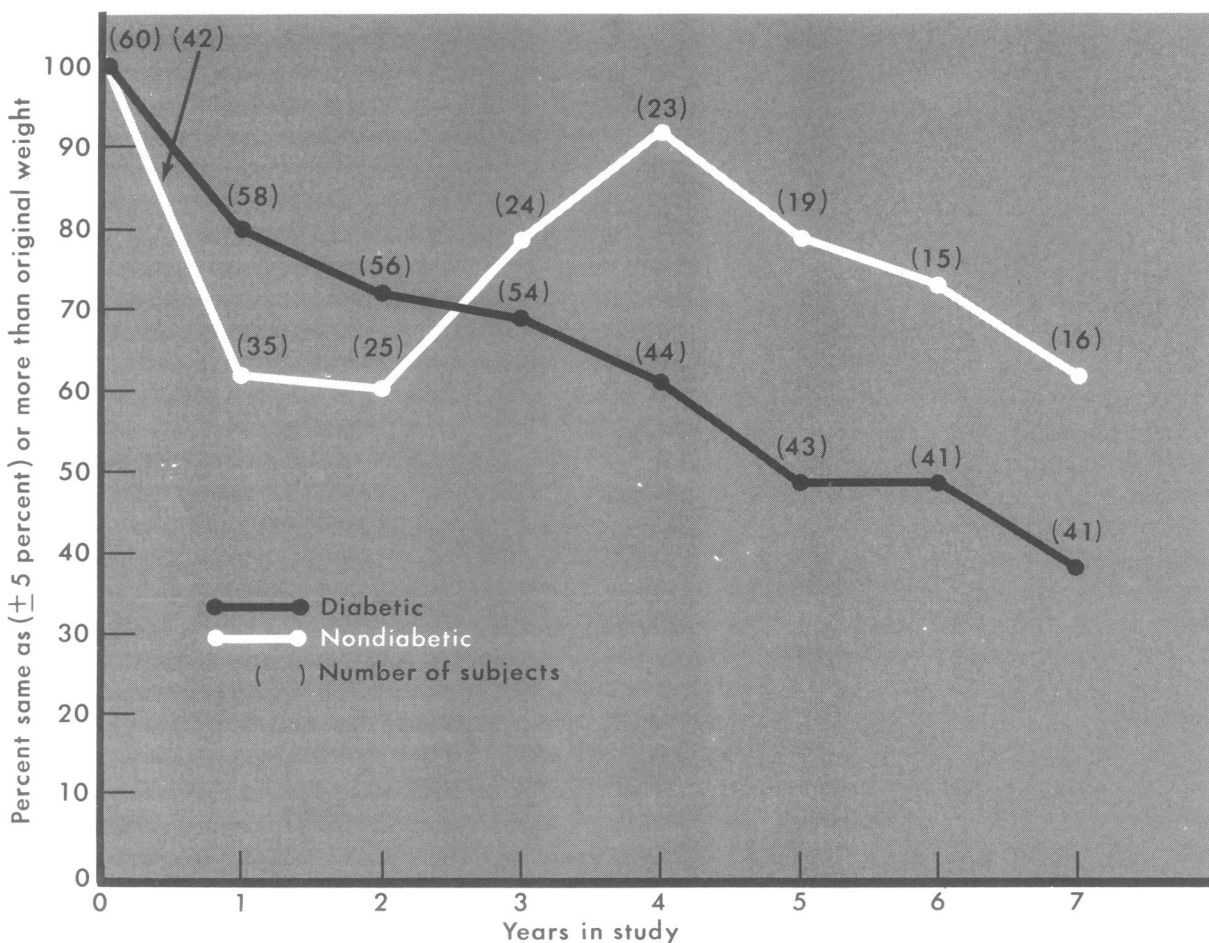
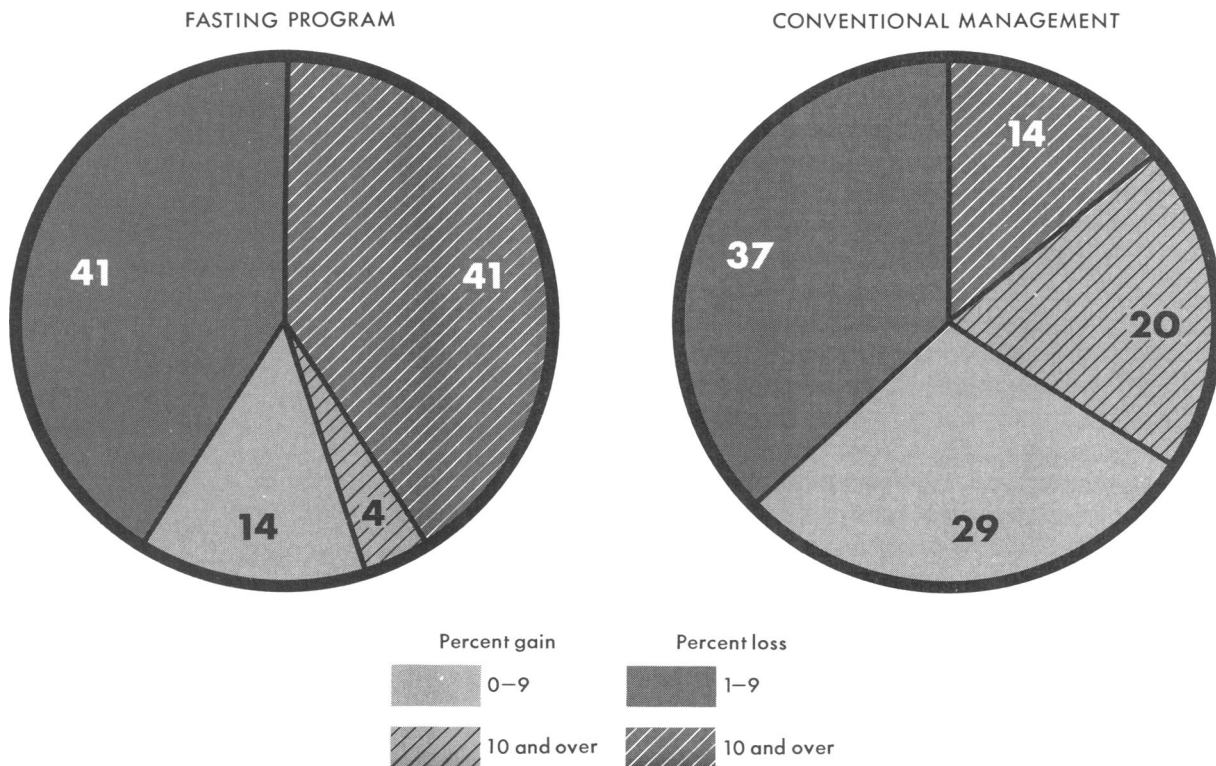


Figure 3. Comparison of percentage of long-term weight change between the fasting program and conventional management



NOTE: Figures in sectors are percentages of subjects.

pated several years before final weight determinations were made. The major impact was short term. Most patients regained 15 to 30 percent of the lost weight within a few days or weeks of refeeding, and a few regained most of it within a few months. However, their subsequent weight pattern was generally more favorable than that of the CM patients. Perhaps fasting produced a durable physiological or psychological effect.

Hollifield and associates (17) demonstrated that prolonged fasting decreased the ability of human beings to synthesize fat, as shown by reduced incorporation of C¹⁴ labeled glucose into the lipids of adipose tissue. This reduced fat synthesis appears to result from an "atrophy" of the enzymes of the hexosemonophos-

phate shunt, since lowered activity of both glucose-6-phosphate (G6PD) and 6-phosphogluconic dehydrogenase (6PGD) were found in adipose tissue after fasting. If these fasting effects persist, they might relate to the long-term superiority of results from initial fasting compared with conventional therapy in the present investigation. However, in animal studies (18) refeeding restored the enzyme activity of G6PD and 6PGD as well as the lipogenetic capacity of fat tissue; and the periods of fasting and refeeding produced no apparent change in the number of fat cells.

After fasting, the amount of food intake required to produce a sense of satiety is smaller than previously (17). The hypothalamic satiety centers may become more sensitive or the

appetite center may be depressed. Whether these effects of fasting on the satiety response are lasting or only temporary has not been established.

Perhaps the long-term potentiality of the FP may counterbalance its expense and inconvenience. The findings of this study suggest that the fasting program is most successful in the intermediate age group (30-49 years) of diabetic men who weigh 250 pounds or more. Therefore, clinicians may be justified in emphasizing the fasting program for such diabetics, as well as considering it for other well-motivated overweight patients.

REFERENCES

(1) Society of Actuaries: Build and blood pressure study. Chicago, 1959, vol. 1.

- (2) Sievers, M. L.: A study of achlorhydria among southwestern American Indians. *Am J Gastroenterol* 45: 99-108, February 1966.
- (3) Bloom, W. L.: Fasting as introduction to treatment of obesity. *Metabolism* 8: 214-220, May 1959.
- (4) Stewart, W. K., Fleming, L. W., and Robertson, P. C.: Massive obesity treated by intermittent fasting. *Am J Med* 40: 967-986, June 1966.
- (5) Mayer, J.: Reducing by total fasting. *Postgrad Med J* 35: 279-282, March 1964.
- (6) Duncan, G. G., Jenson, W. K., Fraser, R. I., and Cristofori, F. C.: Correction and control of intractable obesity. *JAMA* 181: 309-312, July 28, 1962.
- (7) Duncan, G. G., Jenson, W. K., Cristofori, F. C., and Schless, G. L.: Intermittent fasts in the correction and control of intractable obesity. *Am J Med Sci* 245: 515-520, May 1963.
- (8) Drenick, E. J., Swendseid, M. E., Bland, W. H., and Tuttle, S. G.: Prolonged starvation as treatment for severe obesity. *JAMA* 187: 100-105, Jan. 11, 1964.
- (9) Thomson, T. J., Runcie, J., and Miller, V.: Treatment of obesity by total fasting for up to 249 days. *Lancet* No. 7471: 992-996, Nov. 5, 1966.
- (10) Laszlo, J.: Changes in the obese patient and his adipose tissue during prolonged starvation. *South Med J* 58: 1099-1108, September 1965.
- (11) Benoit, F. L., Martin, R. L., and Watten, R. H.: Changes in body composition during weight reduction in obesity. Balance studies comparing effects of fasting and a ketogenic diet. *Ann Intern Med* 63: 604-612, October 1965.
- (12) Felig, P., Owen, O. E., Morgan, A.P., and Cahill, G. F.: Utilization of metabolic fuels in obese subjects. *Am J Clin Nutr* 21: 1429-1433, December 1968.
- (13) Ball, M. F., Canary, J. J., and Kyle, L. H.: Comparative effects of caloric restriction and total starvation on body composition in obesity. *Ann Intern Med* 67: 60-67, July 1967.
- (14) Parsons, W. B.: Changes in serum cholesterol, beta-lipoproteins, cholesterol and triglyceride levels in hospitalized patients on zero-calorie diets. *Circulation* (supp. III) 33, 34: 24, October 1966.
- (15) Stunkard, A., and McLaren-Hume, M.: The results of treatment for obesity. *Arch Intern Med* 103: 79-85, January 1959.
- (16) Glennon, J. A.: Weight reduction—an enigma. *Arch Intern Med* 118: 1, 2, July 1966.
- (17) Hollifield, G., Owen, J. A., Jr., Lindsay, R. W., and Parson, W.: Effects of prolonged fasting on subsequent food intake in obese humans. *South Med J* 57: 1012-1016, September 1964.
- (18) Anderson, J., and Hollifield, G.: The effects of starvation and re-feeding on hexosemonophosphate shunt enzyme activity and DNA, RNA and nitrogen content of rat adipose tissue. *Metabolism* 15: 1098-1103, December 1966.

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In a long-term comparative study of two weight-reduction programs among southwestern American Indians, those who underwent an initial fasting program and subsequent conventional therapy achieved better results than the matched patients who received only conventional low-calorie dietary management.

An increasingly greater percentage of the fasting program patients than the conventional management patients weighed less than originally for each of the 7 years of followup.

During the investigation the change in mean

weights was statistically significant ($P < 0.05$) for the fasting group (-8.7 percent) but not for the conventional program patients ($+0.5$ percent). Weight loss was proportionately greater for men than for women, for the intermediate age group (30-49 years) than for those younger or older, for diabetics than for nondiabetics, and for persons weighing more than 250 pounds. The initial fasting program improved the long-term results of conventional low-calorie dietary treatment for obesity.