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INCREASED CONSUMPTION OF PROTEIN DECREASES BODY WEIGHT AND FAT PREFERENCE. HAMILTON, JAN, PH.D., HUMAN NUTRITION AND FOOD, LOUISIANA STATE UNIVERSITY, BATON ROUGE, LOUISIANA, 70808.

Thirty three billion dollars was spent on weight loss in the USA last year according to Dr. Richard Atkinson, President of the American Society for Clinical Nutrition. The 1988 Surgeon General's Report on Nutrition and Health reports obesity to be the nation's number one nutritional problem. The Healthy People 2000 (1990) document reports that for 2 out of 3 Americans who neither smoke nor drink, eating patterns may shape their long-term health prospects more than any other choice. Due to increased longevity, the average U.S. woman will spend one-third of her life as a postmenopausal individual (Greendale and Judd, 1993). Weight management during the postmenopausal years is of paramount importance. This increasing segment of the population challenges the medical community to focus on health problems compounded by obesity: cardiovascular disease, cancer, hypertension, osteoporosis and diabetes mellitus. Recent census data from the U.S. indicate that in the 1990s the number of women above the age of 50 years will approach 40 million and that a 50-year-old has a 30 year projected life-span. It is vitally important to identify dietary and physiological factors that uniquely predispose women to overeating and weight gain. This research sought to systematically measure the effects of female sex hormones on ingestive behavior, caloric intake, and macronutrient composition. These are important relationships to study because overeating and obesity have often been implicated in complications of longevity and health status over the life span (Rodin, Moskowitz, and Bray, 1976; Weiffenbach, 1977; Rodin, 1980; Drewnowski, Brunzell, Sande, Iverius, and Greenwood, 1985).

Hormone replacement therapy is chosen by a growing segment of the postmenopausal population. Mid-life body weight gain is perceived to increase further if exogenous female sex hormones are included in menopause. The purpose of this research was to examine patterns of caloric intake, nutrient composition, and body fat in the female rat model (retired breeding) as affected by exogenous estrogen and progesterone, following an ovariectomy. The animals were ovariectomized for two reasons: (a) to remove endogenous hormone production so that controlled levels could be implanted and documented, and (b) to mimic the menopausal state in an animal model. The study was designed to yield data to assist in understanding how ingestive behavior, specific appetites, hunger motivation and body weight vary in relation to female sex hormones, following the hysterectomy or in postmenopausal women. To examine hormonal effects on caloric intake (CI), carbohydrate (CHO), FAT, protein (PRO), and body weight (BW) in a female model, a group (n=43) of Sprague-Dawley postbreeder rats (10 mos., 10 litters of pups) were ovariectomized (OV) and implanted with 17 β estradiol (E) and/or progesterone (P), or placebo. Uterine weights and radioimmunoassay of serum confirmed hormonal bioactivity. The sham (S) group with placebo implant was used for comparison.

Exogenous hormones were implanted subcutaneously with hormone treatments or placebo administered in silastic tubing according to the following treatment groups: GROUP A Sham: Placebo (empty sealed silastic tubing) GROUP B 0V: Placebo (empty sealed silastic tubing), GROUP C OV: 17 B Estradiol crystalline (15mg.), GROUP D OV : 17 B Estradiol (15 mg.) and progesterone (200 mg.) crystalline, GROUP OV E: Progesterone (200 mg.) crystalline. 24 hour ad libitum food choice of the three macronutrients in separate food cups FAT, CHO, and PRO was allowed. Measurement of data on the hormonal effects of caloric intake and body weight was calculated from each macronutrient group for a 10 day period of time in phase I. In phase I of the hormonally implanted animals, the group consuming the highest protein gained the least amount of body weight (Figure I). The OV and P groups which consumed the highest % calories from carbohydrate ($p<.0009$) gained the most BW ($p<.008$). The absence of estrogen appears to increase body weight, however with increased protein, this body weight gain appears to be suppressed. Further investigation of energy intake and metabolism in the postmenopausal female taking hormone replacement therapy is needed.

The animals were followed for 30 days. The total study % of macronutrient calories and % BW increases were observed: Sham (normally cycling female rat) (BW, 10.4%) consumed 56.5% of CI from FAT, 38.0% CHO, 5.5% PRO; OV (BW, 23.1%) 37.5% FAT, 53.9% CHO, 8.6% PRO; E (BW, 15.7%) 49.3% FAT, 43.5% CHO, 7.1% PRO; E&P (BW 16.7%) 48.3% FAT, 40.4% CHO, 11.3% PRO, P (BW, 20.8%): 48.5% FAT, 46.1% CHO, 5.4% PRO. The total % fat in body composition analysis was S 8.2%, OV 8.2%, E 9.5%, E&P 10%, P 8.6% ($p<.0945$). Therefore, percent body fat stores did not reflect % of fat intake. Estrogen treatment decreased body weight gain ($p<.0002$) with no significant differences in caloric intake. Caloric conversion ratios defined as body weight gain divided by caloric intake, between the 5 treatments ($p<.003$), in ascending order were: S:12.3, E:16.0, E&P: 16.8, P:21, OV: 22.1.

The animals receiving E&P implants consumed three times as much protein as the S animals ($p<.002$), consumed the fewest calories and gained the least amount of body weight of any hormone treated group. Body weight was significantly less than ovariectomized animals receiving no hormone implant. This is important because this is the regime of exogenous female sex hormones most often prescribed by physicians for postmenopausal females for treatment for osteoporosis, cardioprotection and menopausal symptoms. Animals implanted with exogenous female sex hormones chose greater protein intake levels than S. In the OV treated

animals the correlation coefficient between the protein intake and body weight was equal to -0.751($p<.01$). The correlation coefficient for the conversion of caloric intake into body weight was equal to -.852 ($p<.0008$). In the E treated animals the higher the protein intake, the lower the fat intake -.609 ($p<.05$) and the lower the caloric conversion ratio ($p<.0001$)which is the body weight gain divided by the caloric intake. This may indicate that protein is more satiating and suppresses the ad libitum food choice of high fat foods. The implications of this to eating behavior and body weight gain are: higher protein may be chosen by females taking exogenous female sex hormones which in turn may satiate and suppress the choice for high fat foods. Increased protein intakes may assist the female in resisting high calorie fat and high calorie carbohydrate foods which may be craved by women during hormonal phases often resulting in undesired body weight gain.

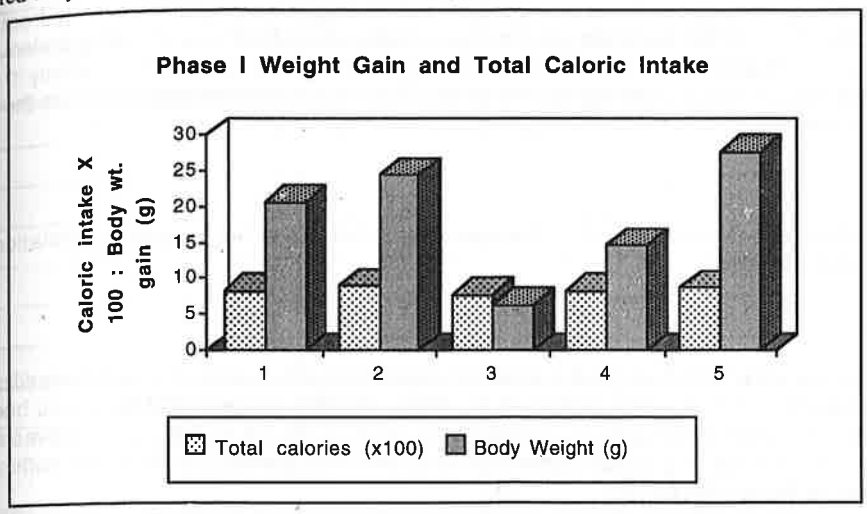

Figure 1.0 Body weight gain and total kcal intake from three food choices for Phase I :
Treatment: 1. Sham , 2. No hormone 3. Estrogen , 4. Estrogen and Progesterone, 5. Progesterone. 2-5 were ovariectomized

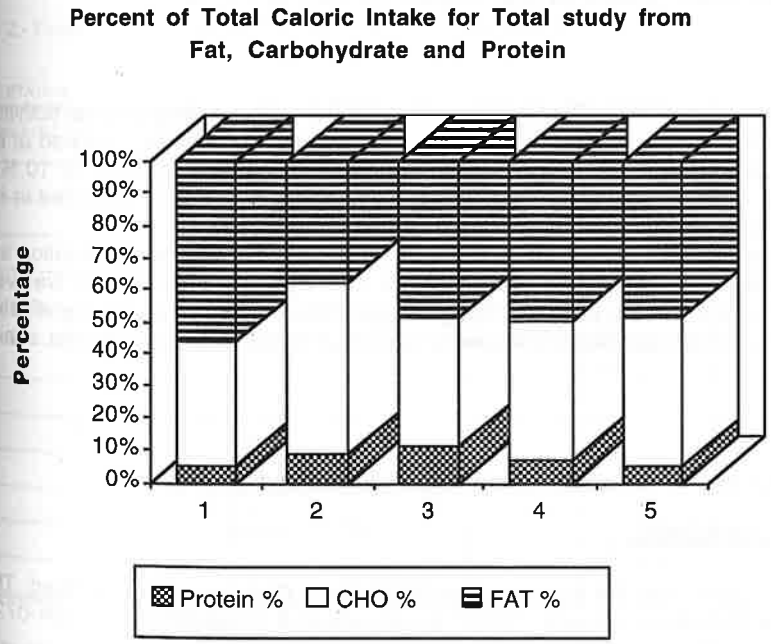

Figure 2.0 Percent of total caloric intake for total study from fat, carbohydrate, and protein treatment: Treatment: 1. Sham, 2. No hormone, 3. Estrogen, 4. Estrogen and Progesterone, 5. Progesterone. 2-5 were ovariectomized.