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Whey protein preloads are more beneficial than soy protein preloads in regulating appetite, calorie intake, anthropometry, and body composition of overweight and obese men

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ABSTRACT

High-protein diets exert beneficial effects on appetite, anthropometry, and body composition; however, the effects of protein preloads depend on the amount, type, and time of consumption. Therefore, we hypothesized that long-term supplemental preloads of whey protein concentrate (WPC) and soy protein isolate (SPI) consumed 30 minutes before the largest meal would decrease appetite, calorie intake (CI), and anthropometry and improve body composition in overweight and obese men in free-living conditions. The subjects included 45 men with a body mass index between 25 and 40 kg/m^2 and who were randomly allocated to either the WPC (n = 26) or SPI (n = 19) groups. For 12 weeks, the subjects consumed 65 g WPC or 60 g SPI that was dissolved in 500 mL water 30 minutes before their ad libitum lunch. Appetite, CI, anthropometry, and body composition were assessed before and after the study and biweekly throughout. After 12 weeks, mean changes between the groups were significant for appetite (P = .032), CI (P = .045), anthropometry (body weight [P = .008], body mass index [P = .006], and waist circumference), and body composition (body fat mass and lean muscle [P < .001]). Relative to baseline, within-group mean changes from WPC were significant for appetite, CI, anthropometry, and body composition (P < .001). In the SPI group, mean changes were significant, relative to baseline, for all variables except lean muscle (P = .37). According to this 12-week study, WPC preloads conducted 30 minutes prior to the ad libitum main meal exerted stronger beneficial effects than did SPI preloads on appetite, CI, anthropometry, and body composition of free-living overweight and obese men.

Abbreviations: BFM, body fat mass; BMI, body mass index; BW, body weight; CI, calorie intake; LM, lean muscle; PAs, physical activities; SPI, soy protein isolate; TCI, total calorie intake; VASs, visual analog scales; WC, waist circumference; WPC, whey protein concentrate.

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1. Introduction

Overweight and obesity are characterized as major modifiable risk factors for cardiovascular morbidity and mortality [1]. Successful weight reduction requires a stable appetite and energy expenditure, along with negative energy balance and preserving or increasing lean muscle (LM) [2], which are mostly met by calorie-restricted diets [3]. However, evidence shows that a 10% to 20% body weight (BW) reduction via calorie restriction decreases resting energy and total energy expenditure due to fat-free mass, which in turn stops BW decreases [4]. In contrast, manipulating dietary macronutrient composition, especially elevating protein intake, is found to be more effective in BW management because protein increases thermogenesis and satiation [2] of dieters. Noteworthy, physiologic effects of proteins on appetite, anthropometry, and body composition are closely related to parameters that include source, dose, ingestion time, and form (solid or liquid) of proteins [5–9]. There is a negative relationship between dairy consumption and metabolic disorders [10] that is contributed to milk proteins, specifically whey [11]. Whey protein, the by-product of cheese production, has the highest level of branched amino acids (leucine, Isoleucine, and valine) [11] that can influence appetite and food intake [11,12] as well as improve BW and composition [13]. However, it has been shown that soy protein exerts beneficial effects on appetite as well as BW and composition because of its conglycinin protein [14] and cysteine amino acid contents [15]. Despite numerous studies comparing the effects of high-protein diets from mixed sources, studies focusing on the effects of long-term supplemental whey protein concentrate (WPC) and soy protein isolate (SPI) preloads on appetite, calorie intake (CI), and BW and composition management before ad libitum food intake are scarce. Similar studies have not considered the effects of the interval between treatment protein and the next meal [5], adequate dose of treatment protein [8,16,17], and the form of protein preloads [8]. In addition, in studies comparing slow proteins (eg, casein) with fast ones (eg, whey) [6,11,18], it is difficult to separate the gastric-emptying rate effects of proteins from their physiologic characteristics. Depending on their source, proteins having different gastric-emptying rates (ie, fast or slow proteins) [19], and thereby, the effects on appetite and CI differ.

Thus, we hypothesized that supplemental preloads of WPC and SPI would decrease appetite, CI, and anthropometry and alter the body composition of healthy overweight and obese men in free-living conditions. To test this hypothesis, we supplemented free-living overweight and obese men with WPC and SPI 30 minutes before their *ad libitum* afternoon meals, and monitored each subject's appetite, CI, anthropometry, and body composition.

2. Methods and materials

2.1. Study population and design

Using a monthly bulletin to advertise, volunteer employees of a power plant in Karaj city were recruited to participate in the study. The study population was calculated for 46 (according to apolipoprotein B that was examined in this research, but related results are not reported in this article), but this was increased to 52 in order to accommodate possible participant dropouts. A total of 7 visits were conducted: one prior to the study to screen and collect baseline data and then one at the end of weeks 2, 4, 6, 8, 10, and 12 to complete questionnaires for 24-hour dietary recalls, appetite, anthropometry, and body composition measurements. The senior researcher completed all questionnaires to minimize misreporting. Of 85 volunteers, 52 men between 30 and 65 year of age with a body mass index (BMI) of 25 to 40 kg/m^2 were recruited. Inclusion criteria included the following: no cigarette smoking and/or alcohol consumption, no medication and/or supplement usage, no high amounts of caffeine consumption (>250-300 mg/d), no history of diseases or clinical problems that increase oxidative stress (injuries or burns), no allergy to soy/cow's milk, and no severe weight changes within the last 3 months (based on each employee's medical history records and his physical examination by the physician at the power plant). Exclusion criteria included any changes in physical activities (PAs), diets, and a compliance of 70% or lower for consumption of treatment beverages.

At the first visit, eligible participants were randomly assigned to either the WPC or SPI (26 in each) group, using a convenience allocation. Individuals were instructed to deliver empty sachets in exchange for full ones at visits 2 through 12, in order to calculate compliance. All participants had ad libitum access to calories and were asked to maintain their usual dietary intake and PA levels throughout the study. Daily, they were instructed to dissolve 1 sachet in 500 mL water and drink it 30 minutes before their afternoon meal (traditionally, the largest Iranian meal). Aside from assessing compliance at biweekly visits, participants were directly observed during random lunchtime visits at their workplaces, in order to ensure the supplements were appropriately consumed. Prior to participation, each volunteer provided written informed consent. The present study was conducted according to Consolidated Standards of Reporting Trials guidelines [20] and is registered in the Iranian Registry Clinical Trials (IRCT201109062365 N3). The Ethics Committee of Tehran University of Medical Sciences approved this study (Ethics Committee: 2011-06-17-13475-43649).

2.2. Treatment beverages

Preload proteins included 80% WPC (DMV, Veghel, the Netherlands) and 90% SPI (Red Crown, Qingdao, China), with similar color and texture. Sachets contained 67.5 g WPC and 60 g SPI (54 g effective compound as a protein/sachet). Calorie contents of WPC and SPI sachets were 261.8 and 216 kcal, respectively. They were closely matched for taste with strawberry flavor and sucralose (Vita Sweet, Beijing, China; 0.2 and 0.1 g in each sachet respectively), as a no-energy sweetener because sucralose is not metabolized in the body and has no effect on blood glucose or insulin secretion [21]. After packing 4368 similar sachets, they were numbered 1 to 84. The numbers were randomly divided into groups A and B (SPI and WPC, respectively) and kept by the executive director of research until study commencement. Hence, all groups were blinded for both participants and the senior researcher. Protein concentration of treatment beverages was 13% for WPC and 12% for SPI.