# Weight Reduction through Inhalation of Odorants

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## Abstract

Despite the pervasive problem of obesity and the expenditure of billions of dollars devising methods of losing weight, no studies have been published on the role of the olfactory sense in determining weight. To assess the effect of inhalation of certain aromas upon weight control, we studied 3193 overweight volunteers. Their average age was 43 years, average height 65 inches, and average weight 217 pounds. Each was given an inhaler containing a blend of odorants and instructed to inhale three times in each nostril whenever feeling hungry. New inhalers containing a new blend of odorants were supplied each month over a period of 6 months. Those subjects whose test scores showed they had good olfactory abilities and who use their inhalers frequently, ate 2 to 4 meals a day, felt bad about overeating, but did not feel bad about themselves lost nearly 5 pounds, or 2% of body weight per month. It appears possible that inhalation of certain aromas can induce sustained weight loss over a 6-month period.

## Introduction

With a third to a quarter of the American population over weight, obesity is rampant in contemporary society. At any given time, 40% of women and 24% of men are trying to lose weight and of these, 84% of women and 76-78% of men are dieting for this purpose. In the USA, losing weight has become a national obsession. Furthermore, over 30 billion dollars are spent each year devising a plethora of new diets and methods for losing weight, many of which are ineffective.[1]

States of hunger and satiety are known to be of crucial importance in the regulation of weight, and the perception of hunger is multivariant; environmental stimuli, psycho logical substrate, and internal physiology all contribute a share. Everyday experiences attest to the influence of ambient aromas on our appetites; we salivate at the smell of freshly baked cookies and feel nauseated at a whiff of sewer gas. When we are hungry, foods smell better and therefore taste better. Conversely, olfactory ability wanes when we are satisfied, lessening the hedonics of further gustation.[2]

Anatomic connections of the olfactory bulb to the ventromedial nucleus of the hypothalamus, the satiety center, authenticate these observations,3 as does the presence of cholecystokinin, a gastric satiety factor, as a neurotransmitter in the

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olfactory bulb.[4] The fact that patients with acute anosmia often gain weight suggests that a failure of the olfactory-satiety feedback mechanism may be involved.[5]

Thus it is perhaps surprising, that amid the proliferating studies of weight regulation, no reports have been published assessing the role of olfaction. The purpose of our investigation was to explore the effect of odors in regulating body weight-specifically, to determine whether inhaling certain sweet aromas would facilitate weight loss in overweight subjects.

## Materials and Methods

### Subjects

We selected 3,193 volunteers for this study who were at least 10 pounds overweight, between the ages of 18 and 64 years, had no history of asthma, were not pregnant, breast -feeding or planning to become pregnant during the 6-month period of the study.

### Procedure

Subjects were given inhalers containing blends of aromatic ingredients and instructed to inhale three times in each nostril whenever hungry. They were told not to deviate from their usual diet and exercise habits. Then each month for a period of 6 months, the subjects were given new inhalers containing a new aromatic blend in a sequence of peppermint, banana, and green apple. Subjects were weighted monthly.

### Instruments

Subjects' olfactory abilities were measured using the Chicago Smell Test[6] and the thiophane-odor threshold test of Amoore.[7] Odor hedonics were rated using a visual analog scale. **All** subjects completed demographic questionnaires and psychological tests, Beck Depression Inventory,8 and Zung Depression Scales.[9]

### Statistical Analysis

Data were analyzed using Pearson Correlation coefficients and I tests for the difference of two proportions.

## Results

### Subject Population

A typical volunteer subject was a 43-year-old white woman, about 5'5" tall with a medium-sized frame, weighing 217 pounds and whose ideal weight was 129 pounds. She was a Catholic separated from her husband and either an unskilled

**Table 1. Physical characteristics**

| | % of Subjects (n = 3193) |
|---|---|
| SEX | |
| Female | 86.4% |
| Male | 13.6% |
| FRAME SIZE | |
| Small | 11.9% |
| Medium | 57.9% |
| Large | 30.2% |
| RACE | |
| White | 67.9% |
| Black | 25.4% |
| Hispanic | 4.6% |
| | Average |
| Age | 42.9 yrs |
| Height | 64.7 in |
| Initial Weight | 216.9lbs |
| Ideal Weight* | 129.0lbs |

**Based on basal metabolism indl'x*

**Table 2. Social characteristics**

| | % of Subjects (n = 3193) |
|---|---|
| MARITAL STATUS | |
| Separated | 44.5% |
| Single | 23.2% |
| Divorced | 15.4% |
| Married | 13.3% |
| EMPLOYMENT STATUS | |
| Unskilled or unemployed | 75.0% |
| Skilled workers | 25.0% |
| RELIGION | |
| Catholic | 48.8% |
| Jewish | 7.0% |
| Protestant | 6.8% |

worker or unemployed. She exercised 9 minutes a day, used alcohol moderately, and did not smoke or use drugs.

The group was predominantly female-86.4% female and 13.6% male. Physical characteristics are shown in Table 1. Three quarters of the subjects were unskilled workers or unemployed. Only 13% were married. Social characteristics are shown in Table 2.

Slightly more than half the subjects exercised and their average time spent exercising was 9 minutes per day. Most of the group used alcohol moderately, about

one quarter smoked, and one fifth used diet pills. Nine percent used sleeping pills and almost 10% used other nonprescription drugs. Behavioral traits are shown in Table 3.

Slightly over half the subject population consumed three meals a day; almost a third ate fewer than three meals a day.

| Table 3. Behavioral Traits | % of Subjects (n = 3193) |
|---|---|
| Exercised | 50.9% |
| Smoked | 25.1% |
| Daily | 17.7% |
| Used alcohol | 72.1% |
| Daily | 4.3% |
| Weekly | 17.6% |
| Monthly | 15.9% |
| Less | 4.3% |
| Used drugs | |
| Diet pills | 20.6% |
| Daily | 1.8% |
| Sleeping pills | 9.2% |
| Daily or weekly | 2.5% |
| Tranquilizers | 6.6% |
| Daily | 1.5% |
| Marijuana | 4.3% |
| Amphetamines | 0.4% |
| Daily | 0.5% |
| Cocaine | 1.6% |
| Daily | 0.4% |
| Other nonprescription drugs | 9.8% |

Over a third had four to nine snacks a day. Almost all liked chocolate.

Almost half were subject to binge eating and over half craved certain foods. Almost 80% said they ate more when they were nervous. The eating behavior of those in the study is shown in Table 4.

| **Table 4. Eating behavior and food preferences** | % of Subjects (n = 3193) |
|---|---|
| No. of meals/day | |
| <3 | 31.7% |
| 3 | 54.3% |
| 4-9 | 14.0% |
| Snacks/day | |
| 4-9 | 35.5% |
| 3 | 30.8% |
| 0 | 0.5% |
| Like chocolate | 98.9% |
| Eat 5 or more chocolate bars/wk | 54.7% |
| Eat 5 or more bananas/wk | 9.3% |
| Eat 1-5 ice cream bars/wk | 29.3% |
| Eat 1-5 apples/wk | 76.4% |
| Eat 1-5 mint candies/wk | 48.4% |
| Binge eating | 48.7% |
| Favorite binge foods: | |
| Chocolate | 12.8% |
| Potato chips | 9.6% |
| Candy | 7.7% |
| Ice cream | 6.0% |
| Pretzels | 3.3% |
| Crave certain foods | 55.9% |
| Chocolate | 15.6% |
| Candy | 6.7% |
| Potato chips | 4.6% |
| Ice cream | 3.8% |
| Pretzels | 3.1% |
| Fast frequently to control weight | 14.1% |
| Diet currently | 16.7% |
| Eat more when nervous | 79.4% |

**Table 5. Psychological factors upon admission into this study**

| | % of Subjects (n = 3193) |
|---|---|
| Complained of impaired sex life due to overweight | 89.9% |
| Felt bad about overeating | 78.3% |
| Were too tired to do almost anything | 76.0% |
| Perceived themselves as unattractive or ugly | 76.0% |
| Hated themselves | 56.1 % |
| Became irritated more easily than usual | 54.8% |
| Worried about physical health | 53.4% |
| Felt dissatisfied with their lives | 52.9% |
| Criticized or blamed themselves for everything bad that happened to them | 47.7% |
| Lost some or all interest in sex | 46.7% |
| Felt sad most or all of the time | 34.6% |
| Had trouble making decisions | 34.3% |
| Felt guilty much or most of the time | 33.7% |
| Had lost interest in other people | 31.7% |
| Avoided others because of eating problems | 29.7% |
| Cried more than usual or wanted to cry but could not | 24.0% |
| Had times of feeling a failure | 22.7% |
| Had given up hope of losing weight | 20.4% |
| Felt discouraged about the future | 20.1% |
| Felt punished | 15.2% |
| Had no pleasure other than those revolving around food | 10.8% |
| Wished for suicide | 8.0% |

Psychological difficulties were prominent among our subjects.

Impaired sex life, bad feelings about overeating, fatigue, and poor self-image were very common with more than three quarters of the subjects so affected. Over half the subjects said they hated themselves. Indecisiveness, guilt feelings, and loss of interest in others affected about a third of the group. Eight percent said they wished for suicide. Psychological factors upon admission into the study are shown in Table 5.

**Table 6. History of overweight and its effects**

| | % of Subjects (n = 3193) |
|---|---|
| Had been in diet or obesity programs | 51.0% |
| withM.D.s | 23.5% |
| with Weight Watchers | 27.6% |
| with Office-based centers | 22.2% |
| Suffered effects of overweight | |
| Medical problems | 15.7% |
| Previously diagnosed bulimia | 0.7% |
| Previously diagnosed anorexia nervosa | 0.3% |
| Family disharmony | 89.0% |
| Insomnia | 504% |
| Trouble working | 54.2% |
| Had obese mothers | 45.4% |
| Had obese fathers | 26.7% |
| | No. of married subjects (n = 425) |
| Had obese spouses | 79.2% |

The age of onset of weight problems averaged 20.8 years for our subjects, and ranged from birth to 63 years. Slightly over half of those in the group had been in one or more of 66 different diet or obesity programs. Many subjects reported suffering various effects of overweight. Most frequently mentioned was family disharmony, with 89% of the study population naming this problem. Over half the subjects suffered from insomnia and had trouble working as a result of being overweight. Table 6 shows the history of obesity and its effects among those in our study. Many subjects had obese parents: 45% had obese mothers, who averaged 45.4 pounds overweight; about 27% had obese fathers, who averaged 40.6 pounds over weight. Of those who were married (425 subjects), 79.2% had obese spouses, who averaged 38.6 pounds over weight (Table 6) .

## Olfactory Status

Most subjects were able to detect the three odorants in the Chicago Smell Test, namely banana, apple, and mint, and to correctly identify at least one of the three. On Amoore's odor threshold test for thiophane, 85% of our subjects had a threshold within the normal range of -25 to +25 decismels; 15% of subjects had a threshold of 55 decismels indicating hyposmia (Table 7).

| Table 7. Olfactory status | % of Subjects able to Detect | Identify |
|---|---|---|
| Chicago Smell Test* | | |
| Banana | 99.0% | 15.8% |
| Apple | 98.3% | 16.9% |
| Mint | 99.5% | 76.0% |
| Amoore's Threshold Test** | | |
| Thiophane | | |
| -25 decismels | 0.0% | |
| 0 decismels | 12.8% | |
| 25 decismels | 72.2% | |
| 55 decismels | 15.0% | |

**Normal subjects are able to detect all three odors and to identifj at least one.*

***Normal range is* -25 *to* +25 *decismels.*

### Use of Inhalers

Frequency of use of inhalers varied from three times a day (three sniffs in each nostril each time = 18 sniffs) to 48 times a day (288 sniffs).

### Weight Loss

The amount of weight the subjects lost directly correlated with the frequency of their use of the inhalers ($p < 0.002$). Those who showed good olfactory ability, that is, a threshold of 0-25 decismels in Amoore's thiophane test, who correctly identified the apple odorant in the Chicago Smell Test, who ate an average of two to four meals a day and felt bad about overeating but did not feel bad about themselves, experienced an average weight reduction of 4.7 pounds, or 2.1 % of body weight per month. Individuals lost up to 18 pounds per month. Other characteristics that correlated with weight loss were medium or large frame size, not avoiding others, eating fewer chocolate bars, eating more apples, and eating more mint candies. The characteristics that correlate with weight loss and their p values are shown in Table 8.

**Table 8. Characteristics that correlate with weight loss**

| | |
|---|---|
| Frequency of inhaler use | P <0.002 |
| Amoore's thiophane threshold 0-25 decismels | p <0.050 |
| Chicago Smell Test-ability to identify apple odor | p <0.050 |
| Medium or large frame size | p <0.020 |
| Not avoiding others | P <0.005 |
| Not feeling bad about oneself | p <0.005 |
| Liking chocolate | P <0.008 |
| Eating fewer chocolate bars | P <0.040 |
| Eating more apples | P <0.060 |
| Eating more mint candies | P <0.060 |

Subjects who showed poor olfactory abilities, those who tended to snack more than five times a day, and those who disliked chocolate did not lose weight.

## Conclusion

These data suggest that it may be possible for individuals with good olfaction, by inhaling certain aromas, to induce and sustain loss of weight over a 6-month period. Theoretically, this approach may be helpful for use in connection with a program of nutrition and exercise to facilitate weight reduction.

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