



## **Starvation Syndrome The Biology of Starvation – Ancel Keys’ Minnesota study**

In Minnesota in 1944 wartime conscientious objector college students volunteered for research that today remains a good description of what happens when a human partially starves and then re-introduces food. Subjects underwent six months of semistarvation and then 3 months of re-feeding with ongoing observation. Semi-starvation meant about 1570 Calories/ 6570 KJ energy intake, vigorous physical activity and about 25% loss of body weight.

### ***Results of six months of semi-starvation:***

#### **Physical Changes**

- Loss of body weight and size. 40% reduction of basal metabolic rate with an estimated saving of about 600 Cal a day to the body
- Feeling cold, particularly in hands and feet.
- Fluid retention/oedema in ankles and wrists. Slowed pulse and reduced heart volume and cardiac output
- Slow body movements. Less work capacity, endurance, ability to climb, carry loads with 30% decrease in strength. More tiredness
- Giddiness and blood pressure drops with rapid rising. Muscle cramps, nerve tingles, frequent urination, reduced sexual interest and testicular size
- Skin pale, cold, dry, rough. Hair thin, dry and falling out.

#### **Personality changes**

- Increased apathy, depression, tiredness, moodiness, irritability, anxiety, sensitivity to noise, restlessness. Subjects becoming more self-centred and egocentric
- Decreased concentration, self-discipline, mental alertness, comprehension, spontaneous activity, ambition, and interest in life
- Increased feeling of being ineffective in daily living. Subjects could not do many things they wanted to and were frustrated as a result. They were aware of their irritability but unable to control their emotions and aggression
- Less sexual interest, interest in personal grooming and appearance and more neglect of self. Food Preoccupation
- Increased interest in food, talk and thoughts about food, collecting recipes, studying menus, thinking about meal times, craving food, and planning the days eating

- Boring food more acceptable, less fussy about food but demanded hot food
- More possessive about food, anger if saw food being wasted, played with food for longer times, took longer to eat (up to 2 hours for a meal)
- Internal conflict between storing food and ravenously gulping it
- Licked plates, ate all crumbs, increased gum chewing, tea and coffee, smoking, nail biting.

## **Social Behaviour**

- Food became the central topic of conversation.
- The group initially bonded and was happy but then became more serious with more sarcasm and less humour.
- The men became reluctant to be part of a group, plan activities or interact with others.
- Educational programs collapsed.

Following three months of gradual re-feeding:

- Physically dizziness, apathy and lethargy improved first, then slowly tiredness, weakness and sex drive improved.
- Initially discomfort continued and the men gained fat tissue rapidly and soft roundness became their look. In 3 months they gained back half their fat tissue but lean tissue took longer to recover.
- Their mood continued to be low for 6 weeks and many became more depressed and irritable. Morale actually dropped and they lost interest in their previous humanitarian interest in the welfare of starving people in the war. They became more argumentative and aggressive as their energy returned.
- Intense hunger pangs were experienced with 12 weeks of insatiable appetite; they wanted more food even when physically full. Many couldn't stop eating and described feeling very full. They were still preoccupied with food and table manners deteriorated more. The need for dietary freedom was so strong it caused severe emotional crises for some.
- Physical problems occurred with constipation, stomach pains, heartburn, wind, especially when overeating and there was continuing sleepiness, headaches, thirst and fluid retention.
- By week 13 when all restrictions were lifted, most men were able to eat more comfortably and work capacity slowly improved. By week 15, more social behaviour reappeared, table manners became more normal but many were still bingeing. By week 20, most felt normal. By week 33, four subjects were still overeating and a couple who tried to eat less to lose weight couldn't.
- Slowly humour and sociability returned and the men had a more positive attitude towards life.

### Further Reading

Garner, D.M. (1997), 'Starvation symptoms. The effects of starvation on behaviour: Implications for eating disorders', in Garner, D. & Garfinkel P. (eds), *Handbook for Treatment of Eating disorders*, Guilford Press, New York, NY, 145 – 177.