Question: Discuss ways in which appetite can be controlled.

1. **Peptide YY**

 A hormone concerned with hunger and the lack of hunger (satiety). Soon after eating, PYY is secreted into the blood by cells lining the lower small intestine (the ileum) and the colon. The release of PYY begins before nutrients arrive in the lower small intestine and the colon. The further release of PYY is stimulated by nutrients within the lower small intestine and the colon. PYY decreases food intake by inhibiting gut motility. It acts as an "ileal brake" to cause a sense of satiety. PYY is a peptide. Peptide YY is believed to play a major role in reducing food intake and decreasing risk of obesity

Strategies to increase PYY:

* Lower-carb diet: Eat a lower carbohydrate diet based on unprocessed foods in order to keep blood sugar levels stable. Elevated blood sugar may impair PYY's effects
* Protein: Eat plenty of protein from either animal or plant sources
* Fiber: Eat plenty of fiber
1. **Cholecystokinin (CCK)**

 Cholecystokinin is produced by I-cells in the lining of the duodenum and is also released by some neurons in the brain. It acts on two types of recptors found throughout the gut and central nervous system. The most recognised functions of this hormone are in digestion and appetite. It improves udigestion by slowing down the emptying of food from the stomach and stimulating the production of bile in the liver as well as its release from the gall bladder. Bile acts like a detergent making the fat droplets smaller so that enzymes can break it down more easily. Cholecystokinin also increases the release of fluid and enzymes from the pancreas to break down fats, proteins and carbohydrates.

 Cholecystokinin seems to be involved with appetite by increasing the sensation of fullness in the short-term, that is, during a meal rather than between meals. It may do this by affecting appetite centres in the brain as well as delaying emptying of the stomach. However, more research is needed to confirm this finding.

There is also evidence to suggest that cholecystokinin may have a role in anxiety and panic disorders. This is an effect of cholecystokinin released in the brain, not an effect of secretion from other parts of the body.

Strategies to increase CCK:

* Protein: Eat plenty of protein at every meal.
* Healthy fat: Eating fat triggers the release of CCK.
* Fiber: In one study, when men ate a meal containing beans, their CCK levels rose twice as much as when they consumed a low-fiber meal.
1. **Glucagon-like-peptide 1**

 Glucagon-like peptide 1 belongs to a family of hormones called the incretins, so-called because they enhance the secretion of insulin. Glucagon-like peptide 1 is a product of a molecule called pre-proglucagon, a polypeptide which is split to produce many hormones, including glucagon. Because they come from the same source, these hormones share some similarities, so are called ‘glucagon-like’. Cells found in the lining of the small intestine (called L-cells) are the major source of glucagon-like peptide 1, although it is also secreted in smaller quantities by the pancreas and the central nervous system. Glucagon-like peptide 1 encourages the release of insulin from the pancreas, increases the volume of cells in the pancreas that produce insulin (beta cells) and holds back glucagon release. Glucagon-like peptide 1 also increases the feeling of fullness during and between meals by acting on appetite centres in the brain and by slowing the emptying of the stomach.

Suggestions to increase GLP-1:

* Eat plenty of protein: High protein foods like fish and yogurt have been shown to increase GLP-1 levels and improve insulin sensitivity.
* Eat anti-inflammatory foods: Chronic inflammation is linked to reduced GLP-1 production
* Leafy greens: In one study, women who consumed leafy green vegetables like spinach and kale experienced higher GLP-1 levels and lost more weight than the control group
* Probiotics: In an animal study, a probiotic supplement increased GLP-1 levels, which led to a reduction in food intake
1. **Leptin**

 Leptin is a hormone released from fat cells in the adipose tissue. Leptin signals to the brain from the hypothalamus. Leptin does not affect food intake from meal to meal but, instead, acts to alter food intake and control energy expenditure over the long term. Leptin has a more profound effect when we lose weight and levels of the hormone fall. This stimulates a huge appetite and increased food intake.

How is leptin controlled?

Because leptin is produced by fat cells, the amount of leptin released is directly related to the amount of body fat ;so the more fat an individual has, the more leptin they will have circulating in their blood. Leptin levels increase if an individual increases their fat mass over a period of time and, similarly, leptin levels decrease if an individual decreases their fat mass over a period of time

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What happens if there is too much leptin?

Obese people have unusually high levels of leptin. This is because in some obese people, the brain does not respond to leptin, so they keep eating despite adequate (or excessive) fat stores, a concept known as ‘leptin resistance’. This causes the fat cells to produce even more leptin. This is similar to the way people with type 2 diabetes have unusually high levels of insulin, as their body is resistant to the effects of insulin. The cause of leptin resistance is still unclear.

What happens if very little leptin is present?

There is an extremely rare condition called congenital leptin deficiency, which is a genetic condition in which the body cannot produce leptin.

Absence of leptin makes the body think it does not have any fat whatsoever and this results in uncontrolled food intake and severe childhood obesity. In addition, leptin deficiency may cause delayed puberty and poor function of the immune system. This condition can be well treated by leptin injections, which cause dramatic weight loss.

Ways to improve leptin sensitivity;

* Avoid inflammatory foods: Limit foods that cause inflammation especially sugary drinks and trans fats.
* Eat certain foods: Eat more anti-inflammatory foods such as fatty fish
* Exercise regularly: Moderate activity can improve leptin sensitivity.
* Get enough sleep: Studies have shown that insufficient sleep leads to a drop in leptin levels and increased appetite.
* Supplements: In one study, women on a weight-loss diet who took alpha-lipoic acid and fish oil lost more weight and had a smaller decrease in leptin than those in a control group.