

Human Performance & Limitations · Module G — The Fit Aviator

Fitness & Nutrition

Chapter 16 — The body a pilot brings to work: individual physical characteristics, exercise and body weight (BMI), sound nutrition and food hygiene, and the traps of hypoglycaemia and gastric distress.

BOOK

Human Performance & Limitations

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EXAM

DGCA CPL / ATPL — HPL

CHAPTER

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Plate 16.0 — A pilot's fitness is not vanity; it is reserve — the margin the body keeps for the moment the flight demands more.

§ 66

PHYSICAL CHARACTERISTICS — Individual Differences

DGCA-QUOTED

Differences among individuals are remarkable. Besides obvious physical differences (e.g., height, weight, age, sex, build, sitting height, functional reach, leg length, shoulder width, strength, co-ordination etc.), people also differ with respect to other traits like:

- **Auditory threshold,**
- **Understanding,**
- **Vestibular (ear senses),**
- **Smell, touch, kin aesthetic (body feelings),**
- **G-tolerances, etc.**

These traits are relatively stable over time, they differ across individuals, and they influence human behavior.

DGCA-MEDICAL IMPLICATION

This is the underpinning for **cockpit ergonomics** and **pilot-selection standards**: minimum/maximum sitting heights, reach envelopes for switches and rudder pedals, vision and hearing standards, etc. Each pilot is a different statistical sample — and the certification rules are designed so that the *typical* trained pilot can comfortably operate the aircraft, while extreme outliers may be screened out at the medical or flight-school stage.

§ 67

EXERCISE AND WEIGHT

BODY MASS INDEX

$$\text{BMI} = \text{weight (kg)} \div \text{height}^2 (\text{m}^2)$$

MEN — normal BMI 20 to 25

WOMEN — normal BMI 19 to 24

UNDERWEIGHT

NORMAL

OVERWEIGHT

OBESE

Figure 16.1 — Body Mass Index ($\text{BMI} = \text{weight} \div \text{height}^2$) and its categories, from underweight to obese.

67.1 Body Mass Index (BMI)

DGCA-QUOTED — DEFINITION & FORMULA

A person's Body Mass Index, or BMI, is simply a measure of a person's weight in relation to his height.

Body mass Index (BMI) = Weight (kgs) / Height² (m).

DGCA-QUOTED — NORMAL BMI RANGES

Normal BMI for MEN is **20 to 25** and WOMEN **19 to 24**.

$BMI = \frac{\text{kg}}{m^2}$ Weight in kg $\div$ height in m squared

20–25 Normal BMI for MEN

19–24 Normal BMI for WOMEN

WORKED EXAMPLE

A pilot weighs 75 kg and is 1.78 m tall. $BMI = 75 / (1.78)^2 = 75 / 3.168 \approx 23.7$. Within normal range for men (20–25). ✓

67.2 Exercise Prescription & "No appetite suppressants"

DGCA-QUOTED — EXERCISE PRESCRIPTION

Regular exercise is beneficial to general health, but the most efficient way to lose weight is by reducing CALORIC CONSUMPTION.

To reduce the risk of coronary artery disease, exercise should be done to **DOUBLE** the resting heart rate for at least **20 minutes, three times a week**.

DGCA-QUOTED — APPETITE SUPPRESSANTS PROHIBITED

Pilots should **NOT** try to lose weight by taking appetite suppressants.

BEST WAY TO LOSE WEIGHT

Reduce calories

EXERCISE — TARGET HR

2× resting

EXERCISE — DURATION

≥ 20 minutes

EXERCISE — FREQUENCY

3 × per week

APPETITE SUPPRESSANTS FOR PILOTS

Prohibited

67.3 Effects of Being Badly Overweight — 13 DGCA-quoted conditions

DGCA-QUOTED — VERBATIM LIST

Being **badly overweight INCREASES a pilot's susceptibility** to the following conditions:

1. **Heart attack.**
2. **Hypertension.**
3. **Hypoxia at lower altitudes than normal.**
4. **General circulation problems.**
5. **Gout (swollen joints).**
6. **Osteoarthritis** (a form of arthritis characterized by gradual loss of cartilage of the joints).
7. **Diabetes.**
8. **The inability to tolerate G forces.**
9. **Problems with joints and limbs.**
10. **Decompression sickness.**
11. **Heavy sweating.**
12. **Chest infections.**
13. **Varicose veins** (a vein that has become swollen and knotted as a result of faulty valves).

CROSS-LINKS — OBESITY IS THE PILOT'S "COMMON ENEMY"

Note how this single list lights up almost every previous part of the chapter:

- Heart attack & hypertension & circulation problems → §9 / §15 / §61
- Hypoxia at lower altitudes → §10 / §13 (smoker comparison)
- Inability to tolerate G forces → §62 / §64
- Decompression sickness → §19 / §20 (DCS predisposing factor)

The DGCA examiner treats obesity as a *multiplier* of every other risk discussed in the chapter — which is why BMI screening is built into every Class-1 / Class-2 medical.

§ 68

Nutrition and Food Hygiene

DGCA-QUOTED — THE EMPTY-STOMACH RULE

Never fly on an empty stomach. A balanced diet is the foundation of good health.

68.1 Sources of Carbohydrates

DGCA-QUOTED

Sources of carbohydrates include:

- Grains,
- Vegetables,
- Nuts, and
- Fruit.

68.2 Vitamins

DGCA-QUOTED

Vitamins are organic substances required by the body to function properly. They help process other nutrients to form blood cells.

68.3 Minerals — the Three Majors

DGCA-QUOTED

Minerals are essential to many vital body processes — from building strong bones to transmitting nerve impulses.

The three major minerals include:

- Calcium — for healthy bones and teeth.
- Phosphorous — for body's chemical reaction and
- Iron — For Hemoglobin.

NUTRITION FOR THE PILOT

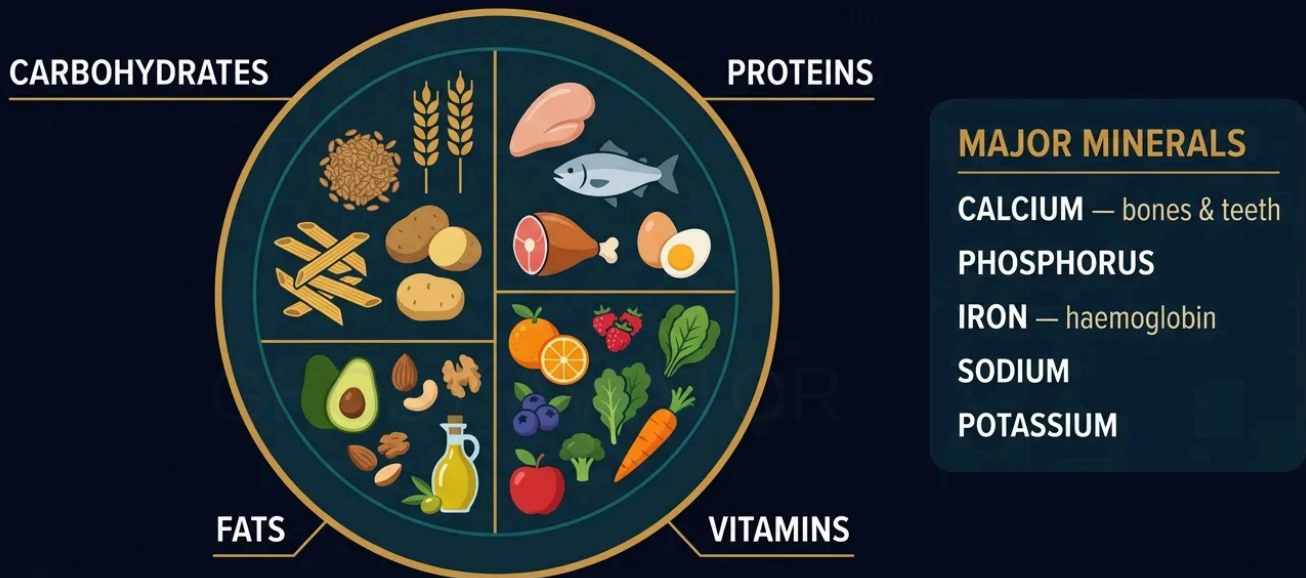


Figure 16.2 — Nutrition essentials: the major minerals — calcium (bones & teeth), phosphorus, iron, sodium and potassium — and a balanced pilot's diet.

GHOST AVIATOR

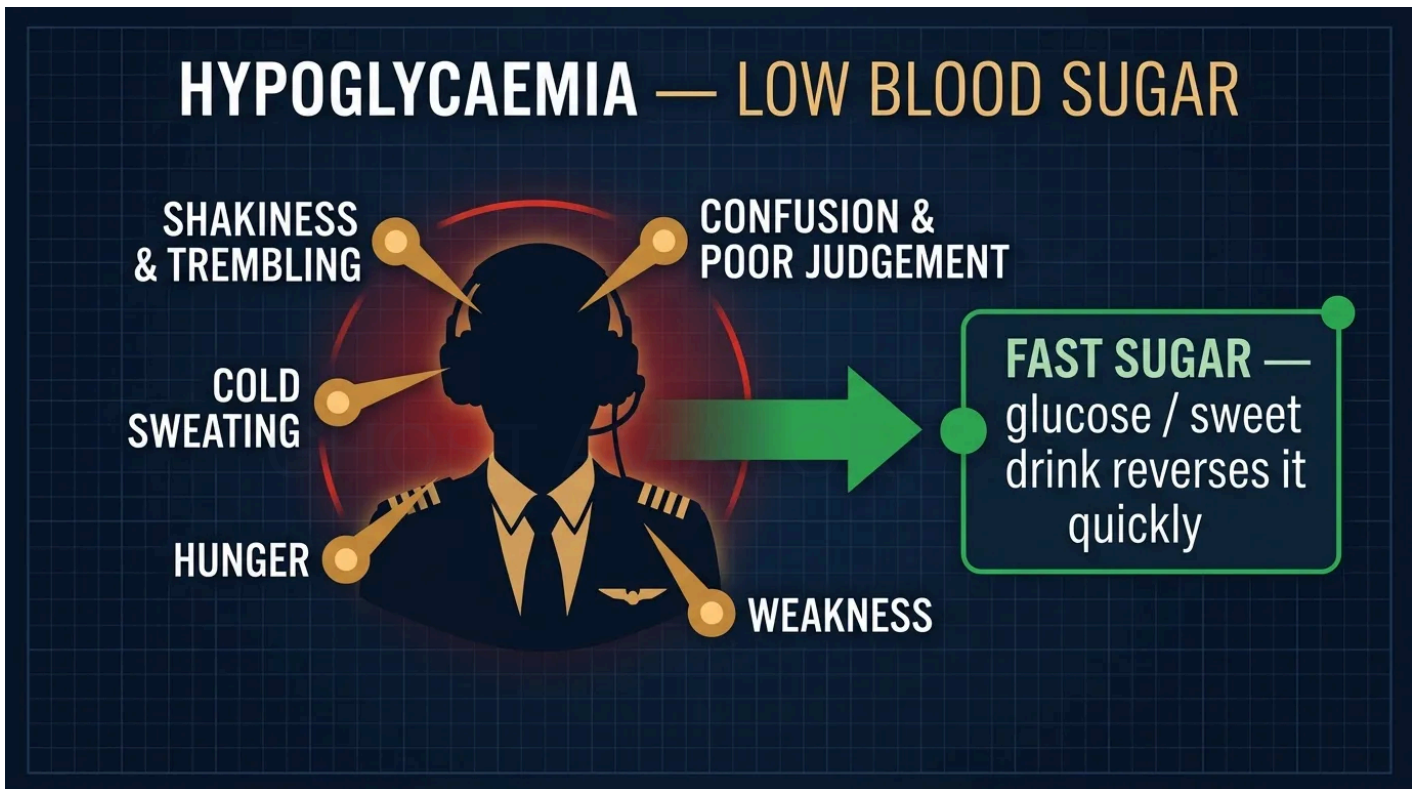


Figure 16.3 — Hypoglycaemia: low blood sugar brings shakiness, sweating and confusion — reversed quickly with fast sugar.

DGCA-QUOTED — THE BRAIN NEEDS FUEL

Just as the brain needs oxygen to function, it also needs fuel to combine with the oxygen and produce energy. That fuel is **blood glucose**, which is carried by the bloodstream and easily passes the **blood–brain barrier**.

DGCA-QUOTED — THE BRAIN CANNOT STORE GLUCOSE

Glucose is a simple sugar and serves as an immediate source of energy for cells.

The brain **CANNOT STORE GLUCOSE** and requires a **CONTINUOUS SUPPLY** to function properly.

All foods containing carbohydrates will raise blood glucose levels.

DGCA-QUOTED — WHAT HYPOGLYCEMIA DOES TO THE PILOT

Failure to eat properly may result in a shortage of glucose (hypoglycemia), which will produce **DECREMENTS IN COGNITIVE FUNCTIONING**.

Research has proved that hypoglycemia significantly compromises performance, resulting in **LONGER RESPONSE TIMES** and **LOWER SCORES** on cognitive tests.

PRACTICAL PILOT RULE

This is the physiological basis of the "**Never fly on an empty stomach**" rule (§68). A pilot who skipped breakfast — or who is on a crash diet — is operating with reduced cognitive performance. This becomes one of the DGCA-listed causes of **subtle incapacitation** (§27.3 — "Temporary hypoglycemia" is listed verbatim).

§ 70

Gastric Distress and Contaminated Foodstuffs

70.1 Four Major Causes of Food Contamination

DGCA-QUOTED — VERBATIM

Major causes of food contamination are:

1. **Unhygienic (i.e. unclean) food preparation.**
2. **Under cooked or stale meats.**
3. **Unwashed salads, fruit or vegetables.**
4. **Seafood and locally made ice-creams and mayonnaise.**

70.2 Gastroenteritis — Pilot Fitness Rule

DGCA-QUOTED — PILOT UNFIT EVEN WITH MEDICATION

Pilots suffering from Gastroenteritis are **NOT FIT TO FLY**, even though they may be taking medicine which is relieving the symptoms.

Due to pressure differential, **TRAPPED GASES ESCAPE AT HIGH ALTITUDES** resulting in extreme discomfort and sickness.

WHY ALTITUDE MAKES GASTROENTERITIS WORSE — BOYLE'S LAW AGAIN

Recall **Boyle's Law** from Part 1 — gas volume increases as pressure decreases. Gut gases that are tolerable at sea level can expand by $\sim 2\times$ by cabin altitude of 18,000 ft (where atmospheric pressure has halved, §19.2). For a gastroenteritis patient already producing excess gas, this expansion → severe abdominal pain, nausea, vomiting, sudden bowel motion — all of which incapacitate the pilot in the cockpit. Anti-diarrhoeal medication may mask the bowel symptoms on the ground but does nothing to prevent the gas-expansion mechanism in flight.

DGCA-QUOTED — SYMPTOMS OF GASTROENTERITIS

- Nausea
- Vomiting
- Abdominal Pain
- Diarrhea, and
- Loss of appetite.

✦ END OF CHAPTER 16 ✦

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