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In exercise of the powers conferred by Rule 39B and 133A of the Aircraft Rules, 1937, the following requirements are hereby issued for information, guidance and compliance.



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DIRECTOR GENERAL OF CIVIL AVIATION

OBESITY & COMMERCIAL AIRCREW

1. Obesity is generally defined as an excess concentration of body fat or adipose tissue. Obesity and overweight are terms often used interchangeably, but they do not necessarily represent the same situation. Some individuals may be overweight but not obese, while obese individuals are overweight to a certain defined degree. Defining obesity is not a difficult task, but measuring obesity can be difficult & controversial. The medical implications of obesity are more of a cause for concern for the employer than the regulatory body, in view of the nature of the disability & its ability to cause acute incapacitation. Overweight and obese individuals are at increased risk for many diseases and health conditions, including hypertension, dyslipidemia, Type 2 diabetes mellitus, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea etc.

2. Currently, no universally agreed upon, cheap, simple, accurate, and reproducible measurement of obesity is available. Each anthropometric measurement or parameter contains inherent advantages and disadvantages. Methods to measure body fat include BMI, Hip Waist Ratio, skinfold thickness, underwater weighing, bioelectrical impedance, dual-energy x-ray absorptiometry (DXA), and computerized tomography. The common indices to measure & grade the degree obesity are listed below.

Body Mass Index (BMI)

3. BMI is one of the better methods to determine who is overweight or obese. It can be performed rapidly in the clinical setting just by measuring the weight and height of the individual. BMI is a reliable indicator of body fat. BMI does not measure body fat

directly, but correlates it to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA). BMI is defined as the weight (in kilograms) divided by the square of the height in meters (kg/m^2).

4. A BMI less than 25 is considered normal by the World Health Organization, while 25 to 29.9 is overweight, and 30 or greater is defined as obese. There are three classes of obesity: Class I is a BMI of 30 to 34.9 kg per m, Class II is a BMI of 35 to 39.9, and Class III is a BMI equal or greater than 40. BMI does not take into account more muscular frames at different heights. Thus, a patient who lifts weights or engages in resistance exercises may actually experience a slight increase in BMI due to an increase in lean body mass which weighs more than fat tissue. However, patients with BMI values equal to or greater than 30 generally have an excess of adipose tissue.

5. The correlation between the BMI number and body fat is fairly strong; however the correlation varies by sex, race, and age. These variations include at the same BMI, women tend to have more body fat than men, older people tend to have more body fat than younger adults & highly trained athletes may have a high BMI because of increased muscularity rather than increased body fatness. BMI is only one factor related to risk for disease; for assessing the likelihood of developing obesity-related diseases, other predictors of morbidity may be considered e.g. waist-hip ratio & other coronary artery disease risk factors.

Waist-to-Hip Ratio (WHR)

6. The Waist / Hip Ratio (WHR) is a measure of truncal obesity. It is a good indicator of weight as a risk factor for diseases such as heart disease. WHR is another simple method to measure obesity. WHR more specifically measures abdominal adipose tissue (circumference) and fat distribution. The waist is simply defined as the largest abdominal circumference midway between the costal margin and the crest of the iliac, in the standing position. The largest circumference just below the iliac crest is defined as the hip. A WHR in women greater than 0.80, and in men greater than 0.90, is a fairly accurate predictor of an increased risk of obesity-related conditions, which is actually independent of BMI. The accuracy in measuring WHR is slightly greater in general for men than women. Postprandial status, standing position, time of day, and even the depth of inspiration can also affect this parameter.

Skinfold Thickness (Skin Calipers)

7. Skinfold measurement has been the most popular method to measure body composition. A skin caliper is needed to measure skinfold thickness or to determine adipose tissue amounts. This method has been appealing because it provides a direct measure of body fat. However, it is limited because not all body fat is accessible to the calipers, such as intra-abdominal and intramuscular fat, and the distribution of subcutaneous fat can vary significantly over the human body. The subcutaneous fat variability can be a problem when measurements at one or several sites are used to represent overall body fat composition. These measurements overall are substantially less

reproducible than most other anthropometric measurements. This method is cheap and fairly easy to perform, but this method is neither accurate nor necessarily useful, because it cannot accurately measure abdominal obesity. The use of triceps and subscapular skinfolds seems to be based on past protocols and convenience. Estimation of body fat by skinfold thickness measurement can use from 3 to 9 different standard anatomical sites around the body. The right side measurement is standard; though in some situations test may be done on the left side e.g. injuries, amputation, deformities, or other medical conditions.

Lean Body Mass (LBM)

8. LBM is a unique method of measurement. It is simply a calculation of the body sites that are not composed of adipose tissue, and are more metabolically active. LBM is predicted by using a complex and imperfect equation one of the more common methods to calculate LBM in some clinical studies is to use the following equation: $2.447 - 0.09516 \text{ age (years)} + 0.1074 \text{ height (cm)} + 0.3362 \text{ weight (kg)}$ divided by 0.732. A greater LBM should correlate with less obesity or fat tissue, although universal agreement on its accuracy remains to be decided. This is primarily due to population or ethnic differences, which can vary substantially. The equation also theorizes, perhaps incorrectly, that the percentage of water in an individual's LBM is constant. Regardless, it is a rapid way of generally accessing lean body mass in individuals from epidemiologic studies.

Assessment of Risk Status

9. The patient's risk status should be assessed by determining the degree of overweight or obesity based on BMI, the presence of abdominal obesity based on waist circumference, and the presence of concomitant cardiovascular disease risk factors or comorbidities. Some obesity-associated diseases and risk factors place patients in a very high risk category for subsequent mortality. Obesity also has an aggravating influence on several cardiovascular risk factors. Patients can be classified as being at high absolute risk for obesity-related disorders if they have three or more of the multiple risk factors listed below.

- (i) Cigarette smoking
- (ii) Hypertension
- (iii) High-risk low-density lipoprotein cholesterol
- (iv) Low high-density lipoprotein cholesterol
- (v) Impaired fasting glucose (IFG)
- (vi) High triglycerides

10. BMI & Waist-hip ratio are to be taken as parameters for grading & assessing obesity in civil aircrew, rather than height – weight tables. During assessment of civil aircrew, it is imperative that holistic view of the weight & associated risk is taken, to prevent unnecessary & repetitive tests, which do not quantify risk assessment. **A significant weight gain or change of weight parameters over a period of time may be**

important in assessing the clinical implications of obese or overweight aircrew & its impact on their overall health. The medical services department of the concerned airline/ authorised medical attendant will have the responsibility of advising aircrew about suitable methods to achieve recommended weight.

11. Based on the above, the following is **recommended for assessment of overweight commercial aircrew, which does not have any other associated clinical disability.**

- (i) BMI 25-29.9: Blood Sugar F & PP (after 75 gm of oral glucose load) & Lipid Profile once in two years, in addition to the mandatory tests at specified age
- (ii) BMI 30-34.9 or WHR > 0.9 for men & 0.85 for women: Blood Sugar F & PP (after 75 gm of oral glucose load), Lipid Profile once a year, in addition to the mandatory tests at specified age
- (iii) BMI 35 & above Blood Sugar F & PP (after 75 gm of oral glucose load), Lipid Profile, once in six months, in addition to the mandatory tests at specified age.

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