



Abnormal and normal physiology – An obesity case study

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1 Introduction

Almost thirty percent of adults in England are obese, with the majority of them being between the ages of forty-five and seventy-four years (Baker, 2021). A person whose body fat levels are so high that it poses risks to his/her health is considered obese. In more measurable terms, an individual with a body mass index (BMI) that exceeds 30 is categorized as obese (NHS, 2019). Complications can develop, many of which may lead to deficiencies in body tissues, organs or entire organ systems (Mafori, et al., 2016). The leading causes of obesity in the UK are sedentary lifestyles, coupled with excessive eating, particularly of fatty and/or sugary foods.

With the onset of COVID-19 and its disproportionate impact on those who are overweight, the UK government saw it necessary to launch a new strategy for tackling the obesity problem. This included a host of measures geared towards encourage people the lose weight (Department of Health and Social Care, 2020), inclusive of a ban on 'buy one, get one free' deals on salty, fatty and sugary foods. Crucially, it also included an expansion of NHS services so that additional people can get the assistance they need in their quest to lose weight.

In this report, we will conduct a brief overview of the normal anatomy and physiology of four organ systems, then examine the extent to which elements of Patient A's lifestyle has contributed to her weight, and could ultimately affect these organ systems in a negative way. The findings of the Health and Lifestyle Questionnaire will be analyzed to identify the relationship between them and Patient A's body functioning/ presentations. Finally, the data from the health and lifestyle questionnaire will be used to make recommendations for holistically improving Patient A's health, while considering her emotional and spiritual needs. Specifically, this report will:

1. Outline the health presentations of Patient A based on the health and lifestyle questionnaire
2. Describe the normal anatomy and physiology of the cardiovascular, respiratory, skeletal and digestive systems
3. Compare the normal form and function of the above organ systems with Patient A's abnormal presentations (where applicable) or with what can develop in Patient A.
4. Suggest necessary lifestyle changes that Patient A should make in order to live a longer, fuller, healthier life.

2 Case Study

2.1 Health profile

Table 1.

Age	45
Gender	Female
Height	160cm
Weight	80kg
Blood pressure	140/90
Cholesterol	High

2.2 Lifestyle/ Risk Factors

2.2.1 Diet

Consists primarily of fast food (burgers, chips, etc.). Mohammadbeigi, et al. (2018) stated that, while there is a wide range of factors that lead to obesity and obesity-related diseases, fast food consumption is the major contributor. Additionally, Patient A stated that she consumes sugary drinks and salty snacks on a daily basis.

2.2.2 Physical activity

Patient A stated that she lives a sedentary lifestyle, engaging in little to no physical exercise. This is particularly the case when she gets home from work. At this point, she usually eats fast food while watching television, before going to bed. It has long been established that sedentary behaviour is a major contributor to obesity (Barnes & Coulter, 2012).

2.2.3 Alcohol consumption

Patient A drinks two (2) glasses of wine per day. According to Traversy & Chaput (2015), the risk of weight gain and ultimately obesity increases significantly for persons who consume alcohol more than seven (7) times per week. This is due to the positive energy imbalance brought on by excessive alcohol consumption. Over time, it may result in weight gain and ultimately obesity, especially so for women. It should be noted, however, that the connection between regular or frequent alcohol consumption and obesity is not yet fully understood (International Alliance for Responsible Drinking [IARD], 2017).

3 Health Assessment

3.1 Normal Anatomy and Physiology

3.1.1 Cardiovascular system

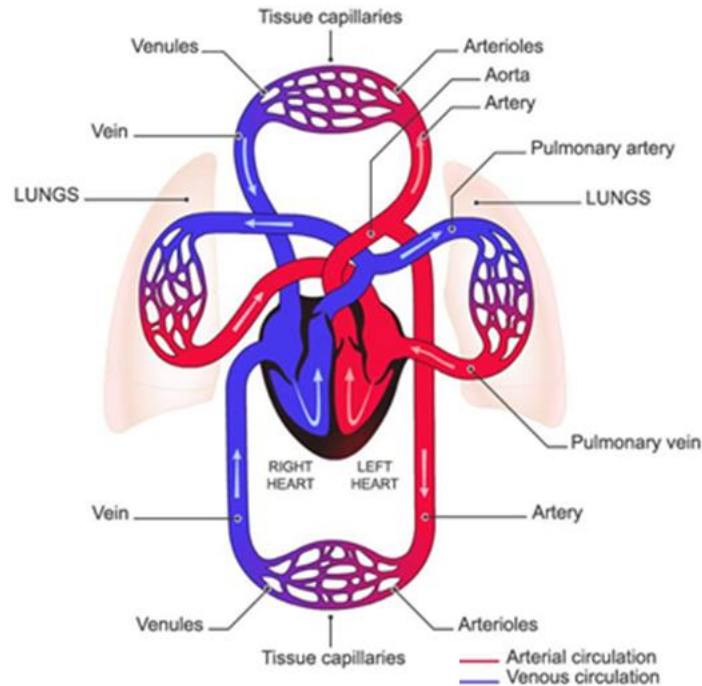


Figure 1. Human cardiovascular system. Source: Boston University (2016)

The cardiovascular system is made up of the heart and blood vessels, which carry oxygenated and deoxygenated blood to and from the organs of the body. Arteries bring oxygen-rich blood from the heart, while veins return deoxygenated from organs to the heart. Capillaries connect arteries and veins to each other. A healthy, efficient cardiovascular system is one that is able to bring the requisite nutrients and oxygen to and from the organs requiring them in a timely, efficient manner (British Heart Foundation, 2021).

3.1.2 Respiratory system

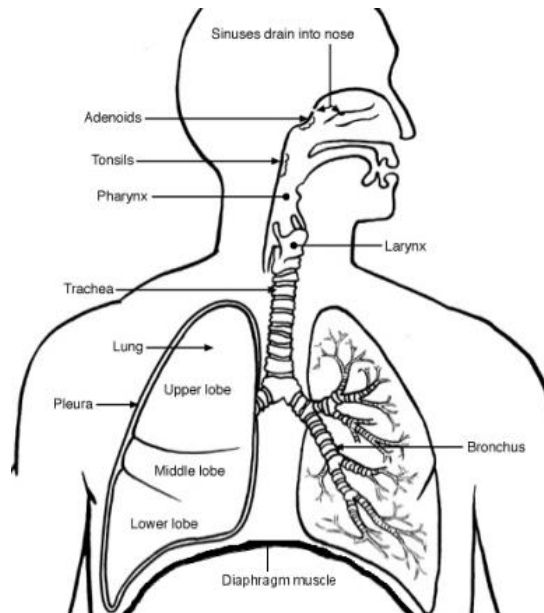


Figure 2. Human Respiratory System. Source: Dezube (2021)

This refers to the web of organs and tissues that allows persons to breath, absorbing oxygen and releasing carbon dioxide. It includes the following anatomical structures: trachea, alveoli, bronchial tubes, intercostal muscles, diaphragm and lungs (BBC, 2021a). A healthy respiratory system depends on the health of each of these structures, and on their ability to work together. To help the body function normally, healthy lungs breathe an average of around twelve times each minute (DeVault, 2017).

3.1.3 Skeletal System

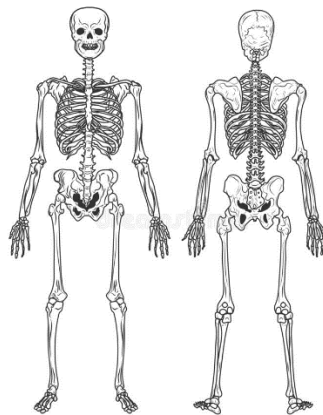


Figure 3. Skeletal system. Source: Deposit Photos (2021)

This is made of up of cartilage and connective tissues and over 200 strong, but flexible bones, and serves to support the weight of the body while protecting vital organs from injury (BBC, 2021b). All components of the skeletal system work together to ensure that humans are able to perform the functions necessary for their survival. Another important feature of the skeletal system is its function as a mineral reservoir, particularly for phosphorus and calcium, which get released into the bloodstream as needed to achieve calcium and phosphate homeostasis (Shaker & Deftos, 2018).

3.1.4 Digestive system

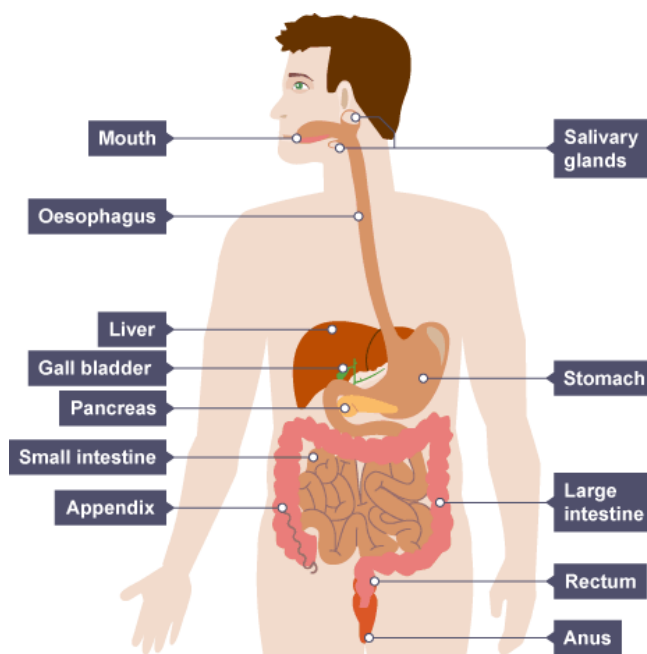


Figure 4. Human digestive system. Source: (BBC, 2021c)

The digestive system consists of a network of organs and tissues, beginning at the mouth and ending at the anus. Between these two points are the stomach, oesophagus, small and large intestines among other organs (see Figure 4), working together to physically and chemically break down and absorb the food and drinks we consume on a daily basis (Guts UK, 2021).

To achieve and maintain good health, it is imperative that one follows a balanced diet, inclusive of a wide range of foods

3.2 Potential Presentations

In this section, we will look at Patient A's potential presentations for the different organ systems based on information gathered during the interview as well as from secondary sources.

3.2.1 Cardiovascular system

Though it was not specifically covered in the health and lifestyle questionnaire, it is very likely that Patient A's high cholesterol and other presentations mentioned in 2.2 could lead to fatty deposits (atheroma) in her coronary arteries, thus constricting them and reducing blood flow to heart muscles – atherosclerosis (NHS, 2020). This occurs when plaque (cholesterol, fatty substances, calcium and other elements) builds up in the lining of arteries, causing the walls to thicken and become rigid – see Figure 5 (John Hopkins Medicine, 2021).

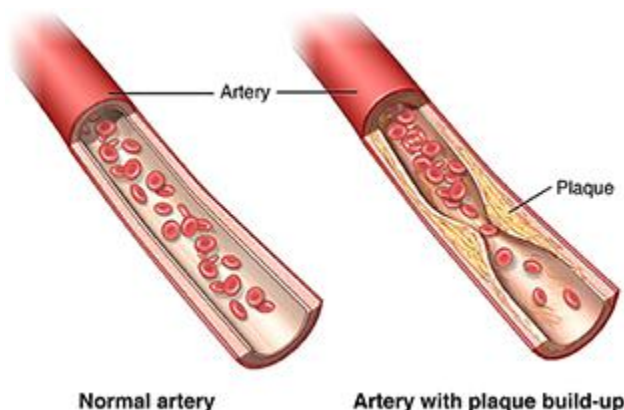


Figure 5. Source: John Hopkins Medicine (2021)

Patient A's dietary and lifestyle choices could also directly affect her heart. For example, it could lead to excessive pericardial fat (fat surrounding the heart), which may then cause significant functional and structural changes to the heart, leading to atrial fibrillation or irregular heart beat (Thanassoulis, et al., 2010).

3.2.2 Respiratory system

The respiratory system does not escape the harmful effects of obesity, as it is a major risk factor for a wide variety of respiratory ailments, such as shortness of breath, and wheezing (Dixon & Peters, 2018). For example, obese people tend to experience varying levels of compression of their lungs, diaphragm, and chest cavity causing restrictive pulmonary damage. Moreover, the surplus fat reduces the strength of respiratory muscles. For the obese, the lungs' normal function and physiology tends to change, particularly when fat has accumulated in the abdominal or chest regions where it causes significant alteration of the chest wall and lungs (Peters, et al., 2019).

The lung volume (particularly expiratory lung volume) of obese people tends to be less than that of those who are not obese. Obese patients tend to have slightly lower blood oxygen levels, and have lower exercise capacity (Littleton, 2020).

3.2.3 Skeletal System

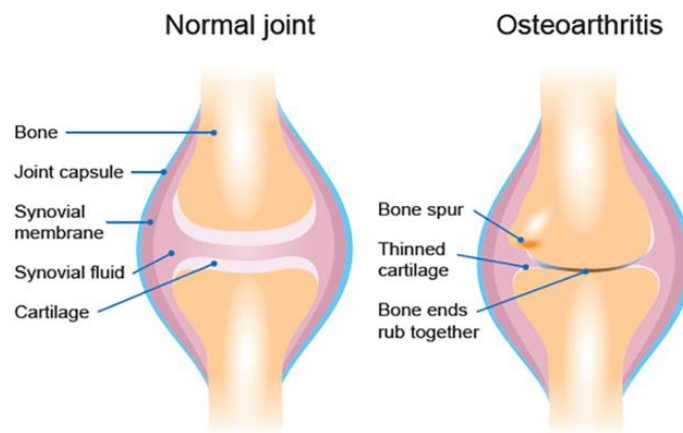


Figure 6. Evans (2021)

Obesity is associated with increased incidence of osteoarthritis (Segula, 2014). Being obese adds excess strain and wear to patients' joints as the cartilage breaks down and bone density declines, leading to osteoarthritis. When this happens, the bones rub together, causing severe pain in some cases. This tends to happen most frequently in the knees, as they bear most of the body's weight. In addition to her weight, the fact that Patient A is female, also contributes to her risk for osteoarthritis (NHS, 2021).

3.2.4 Digestive system

Obesity is the direct cause or a major risk factor for numerous digestive/ gastrointestinal diseases, including but not limited to, erosive gastritis, non-alcoholic fatty liver disease, pancreatitis and cirrhosis (Camilleri, et al., 2017). Obesity and excessive adiposity can result in insulin resistance in patients (Nam, (2017).

In some cases, gastroesophageal reflux disease (GERD) can result from obesity, where stomach acids leak into the esophagus (Cafasso, 2020). This usually manifests in the form of heartburn or vomiting. GERD can be one of either form: erosive or non-erosive, with evidence of tissue damage being associated with erosive GERD (Chang & Friedenberg, 2014).

4 Recommendations

We have seen how Patient A's lifestyle (physical activity, diet, and alcohol consumption) has contributed to her weight and ultimately her obesity. In addition, we see that obesity can lead to a wide variety of harmful effects on the body's systems. Therefore, in order to avoid these effects, Patient A will need to make several lifestyle and dietary changes.

4.1.1 *Diet*

The primary and most effective means of countering obesity is dieting, augmented by an organized plan for physical exercise. It is therefore imperative that Patient A eats less (and ultimately removes) refined sugar and fast food from her daily diet. At the same time, she should incorporate vegetables, whole grains, fruits, and seafood, while limiting her intake of sodium.

Moreover, Patient A should look into restricting her caloric intake, specifically limiting it between 800 and 1500 calories daily (Fock & Khoo, 2013). Once an appropriate weight is achieved – after losing approximately 4kg - caloric intake can be increased to 1417 – 1822 kcal, to balance calories used and calories ingested (see Figure 7 in the Appendix).

4.1.2 *Physical activity*

Consistent physical exercise has the potential to improve the efficacy of dieting, while sustaining the resultant weight loss. (Fock & Khoo, 2013). It is therefore in Patient A's best interest for her to make physical activity a part of her daily life. This lifestyle change should be implemented after she has had consultations with a physician who will guide her in setting appropriate, maintainable fitness goals.

4.1.3 *Alcohol consumption*

Even though the data gathered from the literature suggests that the link between obesity and frequent alcohol consumption is not yet fully understood, Patient A could still achieve multiple health benefits from reducing her alcohol intake. Whether or not this influences her weight is not readily predictable, but the potential to prevent alcoholism (or treat it, if it exists) does make such a lifestyle change a step in the right direction (Cready & Kyle, 2012).

The NHS (2018) advises that both men and women should refrain from regularly consuming in excess of fourteen units of alcohol per week. Patient A would, therefore, need to take the steps necessary to limit her alcohol consumption.

5 Conclusion

We have seen that obesity is a prevalent lifestyle disease in England. Its primary contributors are unhealthy diet and physical inactivity. These risk factors can lead to obesity which itself can have a wide range of negative effects on the body's systems. The increased body mass can add more stress which severely inhibits the normal functioning of joints and the lungs. The digestive and cardiovascular systems are not spared as GERD and atherosclerosis often manifest in obese patients.

In short, an unhealthy diet, coupled with physical inactivity can cause great strains on the human body, and ultimately the health care system. We see where Patient A's current lifestyle and dietary choices has put her at risk of having these and other physical ailments.

In order to effectively remedy these problems or avoid their occurrence, Patient A should modify her current lifestyle by incorporating more physical exercise, eating healthier foods, while cutting back on the other activities that put her at risk of becoming even more obese. The NHS has services available for persons who need additional assistance in achieving and maintaining weight-loss. As such, Patient A should look into utilizing these services.

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7 Appendix

BMI calculator

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31.2

Your result suggests you are **obese**



Healthy weight range for your height:

47.4kg - 64kg

Losing and keeping off 5% of your weight can have health benefits, such as lowering your blood pressure and reducing your risk of developing type 2 diabetes.

Over time you should work towards achieving a healthier weight.

If you're concerned about your weight speak to your GP.

Aim to lose 4kg

Recommended daily calorie intake:

1417 - 1822 kcal

To lose 1-2lbs a week stick to the lower end of the range.

Figure 7. Source: NHS (NHS, 2021)

LIFESTYLE QUESTIONNAIRE

Introduction:

In order to help us focus our Health Promotion activities in the practice, we would be grateful if you could fill in this short questionnaire. If you have already completed one on a previous visit, please return this questionnaire to the receptionist.

Name Date of Birth

Do you smoke? Yes [] No []

If Yes, do you –

smoke less than 1	cigarette/day	[]
1 – 9	cigarettes/day	[]
10-19	cigarettes/day	[]
20-39	cigarettes/day	[]
more than 40	cigarettes/day	[]
smoke a pipe		[]
smoke cigars		[]

If No, have you –

never ever smoked	[]
given up smoking in the last year	[]
not smoked for more than 1 year	[]

Do you have high blood pressure? Yes [] No []

Have you ever had a heart attack
or suffered from angina? Yes [] No []

Have you ever had a stroke, “shock”
or any weakness down one side? Yes [] No []

Have any of the following – mother, father,
brothers or sisters had –

a heart attack below the age of 60	Yes []	No []
a heart attack above the age of 60	Yes []	No []
a stroke	Yes []	No []
trouble with very high cholesterol (hyperlipidaemia)	Yes []	No []

.....

Practice Use Only

Health Education Smoking

BP /

Height

Weight

EXERCISE

Healthy exercise usually involves activity that lasts for at least 20 minutes, raises your pulse and produces hard breathing. In younger people this might be running, cycling or sport, or brisk walking for older people.

Do you take this type of exercise –

- | | |
|----------------|--------------------------|
| daily | ☐ |
| 3 times weekly | ☐ |
| once weekly | ☐ |
| once monthly | ☐ |
| seldom | ☐ |

I cannot take exercise because of disability ☐

DIET

Please tick the one category which is closest to your usual eating pattern.

- | | |
|--|--------------------------|
| I eat no meat, fish or dairy produce | ☐ |
| I eat no meat | ☐ |
| I eat a mixture including daily fruit and vegetables | ☐ |
| I eat a mixture including regular chips and fries | ☐ |
| I eat frozen meals (eg TV dinners) 3 or 4 times/week | ☐ |
| I eat mainly snacks | ☐ |
| I eat a special medical diet | ☐ |

Please specify

ALCOHOL

Please tick the statement which most closely describes your usual average alcohol intake. (1 unit is 1 glass wine, ½ pint beer or a single measure of spirit.)

- | | |
|--|--------------------------|
| I never drink alcohol | ☐ |
| I drink less than 1 unit per day | ☐ |
| I drink between 1 and 2 units a day | ☐ |
| I drink between 3 and 6 units a day | ☐ |
| I drink between 7 and 9 units a day | ☐ |
| I drink more than 9 units a day on average | ☐ |

.....

Practice Use Only

- | | |
|----------------------------|--------------------------|
| Health Education Alcohol | ☐ |
| Alcohol Brief Intervention | ☐ |