Original Article

Comparative analysis of meat and vegetable based meals in wistar rats

Essiet GA1*, Ogbonna OJ1, Okwesileze NC1, Abe PN1

1Department of Pharmacology, Faculty of Basic Medical Sciences, University of Calabar, Calabar, Cross River State, Nigeria.

*Corresponding Author: Essiet Grace Akanimo
Department of Pharmacology, Faculty of Basic Medical Sciences, University of Calabar, Calabar, Cross River State, Nigeria.
E-mail address: onyemajohn59@gmail.com;

Running Title: Comparative analysis of meat and vegetable meals in rats

Received: 04 February, 2016; Revised: 15 March, 2016 Accepted: 10 April, 2016

Available online at http://www.thescientificpub.com

http://dx.doi.org/10.19046/abp.v03i02.05

Abstract

Meat and vegetable has been a daily source of food for human beings consisting of essential vitamins, minerals, macro and micronutrients embedded in them. But at the same time it has been found that they are linked to many disease conditions including cardiovascular diseases, cancer and other chronic disorders. The proximate analysis (%) of these two nutrient sources was carried out and it revealed that both meat and vegetable based meals contain moisture (meat 73.7, vegetable 99.64), protein (meat 32.4, vegetable 32.9), Carbohydrate (meat 34.1, vegetable 50.4), Total fat (meat 18.3, vegetable 4.62), Saturated fat (meat 5.22, vegetable 1.02), Fiber (meat 4.12, vegetable 11.6), Cholesterol (meat 130, vegetable 0), Ash (meat 0.41, vegetable 0.62). From these results it was found that green leafy vegetables are rich sources of protein, fiber and many antioxidants with negligible cholesterol which associates it with a lower risk of cancer, diabetes and heart diseases, while on the other side, meat has the opposite effects of vegetables with many diseases associated with people who consume it frequently. Taken together, it can be concluded that vegetable based meals should be encouraged while excessive meat based meal consumption should be avoided.

Keywords: Meat, Vegetable, Diseases, Wistar rats, Proximate analysis, weight.

Introduction

Meat is the muscle tissue of an animal [1], and a good source of protein, vitamins and minerals in diets. The Department of Health has advised that people who eat a lot of red and processed meat daily more than 90g cooked weight should cut down to 70g [2]. Additionally, some meats are high in saturated fat which can raise blood cholesterol levels [2], with red meat providing iron and vitamin B12 [1]. Some meats contain high fat levels especially saturated fat which can raise cholesterol levels in the blood increasing the risk for heart disease [2]. Meat must be cooked properly before eating to prevent bacterial contamination. Meats like liver is a rich source of vitamin A which if consumed on daily basis causes its accumulation in the body and over years may cause bone fracture on aging [2]. Worldwide, an estimated two billion people live primarily on a meat based diet while an estimated four billion live on plant-based diet [3-6]. Vegetable is any part of a plant that is consumed by humans as food and as a part of a savoury meal [7], it excludes other foods derived from plants like fruits, nuts and cereals but also includes seeds as pulses [7]. Vegetables can be eaten either raw or cooked and play a role in human nutrition [7] with most low in fat and calories [7,8] and supply dietary fiber, and are essential sources of important vitamins, trace elements and minerals [7]. They tend to cause reduction in the incidence of cancer, stroke, cardiovascular diseases and other chronic illnesses when included in meals [7,9,10], and according to
[7,11] individuals who consume less than three servings of fruits and vegetables per day have increased risk of developing coronary heart disease or stroke.

Materials and Methods

Healthy Wistar albino rats weighing 150-250g were used for the study. The present study was carried out for 28 days and were maintained at 22°C under natural 12 hour day-night conditions in the animal house of the Department of Pharmacology of the University of Calabar. Prior to the commencement of the experiments, the rats were acclimatized for at least 5 days and were fed with standard pellet diet and water was available ad libitum. All animal experiments were carried out according to the guidelines for the care and use of laboratory animals published by the National Academies Press [12].

The beef used for the preparation of the meat-based meal and the other condiments was procured from Watt market early in the morning and the vegetables used for the vegetable based meal preparation were also purchased from same market same day and includes carrot, cabbage, pepper, tomato, cucumber and lettuce. The vegetables used for the meal preparation were identified by a plant Taxonomist from Botany Department of the University of Calabar as carrot (Daucus carota), cabbage (Brassica oleracea), pepper (Capsicum annuum), tomato (Lycopersicon esculentum), cucumber (Cucumis sativus), lettuce (Lactaea taraxacifolia), onion (Allium cepa), and curry leaf (Thymus vulgaris).

The beef and vegetables were washed thoroughly and methods used previously by [13-15] were adopted with slight modifications. The resulting prepared samples were labelled and stored in the refrigerator at 4°C and used throughout the study.

Estimation of protein

Protein content was estimated using Kjeldahl method as reported by [16].

Estimation of moisture, ash, fat and fiber

The moisture, ash and fat contents were determined using method of [16].

Estimation of serum cholesterol

The cholesterol levels were determined using method of [17].

Estimation of carbohydrate

The carbohydrate were determined using the following equation

\[
\text{Moisture} + \text{Ash} + \text{Fat} + \text{Fiber} + \text{Protein} - 100 = \text{Carbohydrate}
\]

Blood collection and analysis

One (1) ML of blood was collected from the coccygeal vein of albino rats. The collected blood was centrifuged at 3000rpm for 10 minutes and serum was separated. The enzymatic kit was used to assess the serum levels using spectrophotometer.

Weight changes

The weight changes in the control, rats fed on meat meal and that fed on vegetable meal was determined using calibrated weighing balance on days 7, 14, 21 and 28. The various weight changes were compared with the control.

Statistical Analysis

The data were subjected to analysis of variance (ANOVA) using co-stat-2003 software following the method described by [18]. The Duncan multiple range (DMR) was used to determine the level of significance between samples.

Results and Discussion

Most African countries have a major problem of malnutrition in the majority of areas [16] and even with its increased pace of development, the problems have persisted probably due to the low production of foods, its production process and quality [16,17]. A good number of studies [16, 19-21] have attributed the main cause of hunger and malnutrition in these countries to the unavailability of good quality feeds in terms of protein, energy, vitamin and mineral contents. Food is one of the prime needs of humans for good health, labour, productivity and mental development [22]. Deficiency of protein is widespread and has been cited as the most common form of malnutrition in the developing world [22,23]. Green leafy vegetables are well known for their nutritional importance [22] and they are rich sources of protein, ascorbic acid, carotene, folic acid, riboflavin and minerals like calcium, iron and phosphorus [22,24-27]. Vegetables are rich in fiber, antioxidants and many nutrients that are important for human body, in observational studies, eating vegetables is associated with a lower risk of cancer, diabetes and heart diseases [28-31].

From Table 1, both meals provided similar amounts of protein, indicating that both have a complete protein, vegetable foods provide the same quality and quantity of protein as meat, but with many added benefits embedded in the vegetables. Vegetable based meal provides more carbohydrate than the meat based meal, thus providing...
better and balanced diet, this agrees with the recommendation that carbohydrate should provide most of the total daily calories. Moreover, the meat based meals contain huge levels of total and saturated fats which make it detrimental at times.

Table 1: Proximate composition (%) of meat and vegetable based meals in wistar rats

<table>
<thead>
<tr>
<th>Proximate composition</th>
<th>Control</th>
<th>Meat-based meal</th>
<th>Vegetable-based meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>71.8 ± 0.12</td>
<td>73.65 ± 0.02</td>
<td>99.64 ± 0.02</td>
</tr>
<tr>
<td>Protein</td>
<td>30.6 ± 0.01</td>
<td>32.4 ± 0.01</td>
<td>32.9 ± 0.01</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>88.6 ± 0.02</td>
<td>34.1 ± 0.02</td>
<td>50.4 ± 0.02</td>
</tr>
<tr>
<td>Total fat</td>
<td>7.11 ± 0.01</td>
<td>18.3 ± 0.01</td>
<td>4.62 ± 0.02</td>
</tr>
<tr>
<td>Saturated fat</td>
<td>3.22 ± 0.01</td>
<td>5.22 ± 0.01</td>
<td>1.02 ± 0.01</td>
</tr>
<tr>
<td>Fiber</td>
<td>5.31 ± 0.02</td>
<td>4.12 ± 0.02</td>
<td>11.6 ± 0.02</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>20.0 ± 0.02</td>
<td>130.0 ± 0.02</td>
<td>0.0 ± 0.00</td>
</tr>
<tr>
<td>Ash</td>
<td>0.52 ± 0.01</td>
<td>0.41 ± 0.01</td>
<td>0.62 ± 0.01</td>
</tr>
</tbody>
</table>

The values presented in this table are on dry weight basis and values are Mean ± S.D of three determinations

Table 2: Weight changes (g) of different wistar rats fed with meat and vegetable based meals

<table>
<thead>
<tr>
<th>Parameters</th>
<th>1</th>
<th>7</th>
<th>14</th>
<th>21</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>180 ± 0.01</td>
<td>181 ± 0.01</td>
<td>188 ± 0.02</td>
<td>189 ± 0.02</td>
<td>191 ± 0.02</td>
</tr>
<tr>
<td>Rats on Meat-based meal</td>
<td>186 ± 0.02</td>
<td>189 ± 0.03</td>
<td>200 ± 0.02</td>
<td>220 ± 0.01</td>
<td>236 ± 0.02</td>
</tr>
<tr>
<td>Rats on Vegetable-based meal</td>
<td>210 ± 0.02</td>
<td>211 ± 0.02</td>
<td>212 ± 0.01</td>
<td>218 ± 0.02</td>
<td>221 ± 0.02</td>
</tr>
</tbody>
</table>

The vegetable based meal has more fiber’s than the meat meal. Fiber is an important part of a healthy balanced diet and can help in preventing heart disease, diabetes, weight gain, some cancers and improves digestive health [32]. Meat and its fat are extremely deficient in vitamins [33,34], and antioxidants like A, C, and E which help to neutralize the negative effects of cholesterol by keeping it from oxidizing and being deposited in the arteries, hence promotes arteriosclerosis and increases the risk of heart diseases like myocardial infarction. Meat consumption sometimes results in gout formation which is characterized by high levels of uric acid in the blood and acidification activities, besides it also contains a great number of microorganisms that cause it to decay very fast and produce toxic substances which are very harmful to the body. One cohort study found a positive association between total meat intake and bladder cancer [35], and another found an increased risk for high total processed meat intake [36], hence meat is a source of multiple mutagenic compounds [37] and therefore, excessive intake should be discouraged.

The amount of calories people eat and drink has a direct impact on their weight. Low-fat diets is the key to healthy weight and good health, but part of the problem with low-fat diets is that they are often high in carbohydrate and lack the property of disease prevention [38]. Lower carbohydrate and higher protein diets may have some weight loss advantages in the short-term [39-41] and yet when it comes to preventing weight gain and chronic disease, carbohydrate quality is much more important than carbohydrate quantity. Higher protein and lower carbohydrate improves blood lipid profiles and other metabolic markers and may help in preventing heart disease and diabetes [39, 41-43]. High intakes of red and processed meat are associated with an increased risk of heart disease, diabetes and colon cancer [44-46].

Carbohydrate are hydrolyzed in the body to yield glucose which can be utilized immediately or stored as glycogen in the muscles and liver for future use [47,48]. When carbohydrate are consumed in excess of the body requirements, the excess is converted to fat and stored in the adipose tissue under the skin. Proteins are important in the body for the production of hormones, enzymes and blood plasma. They are immune boosters and can help in cell division as well as growth [47, 49]. Fats are secondary plant products that yield more energy per gram than carbohydrate, and may help to regulate blood pressure and play useful role in the synthesis and repair of vital cell parts [47, 50]. Moisture is a universal solvent that dissolves other substances and carry nutrients and other materials round the body making it possible for every organ to perform its functioning effectively [47,51].

There was a gradual increase in the body weights of the wistar rats fed with meat and vegetable based meals and even in the control from days 7 to 28. In the rats fed with meat meals, the weight increase was more rapid than in the rats fed with vegetable based meal when compared with the control. These observations may have occurred due to the presence of growth stimulants (flavonoid, tannins and alkaloids) and some important minerals and vitamins embedded in the vegetable and meat. These propositions were based on the fact that flavonoids and flavonoid containing foods posses anti-diabetogenic, hypolipidemic and cytoprotective properties [52-54] which may aid in stress reduction [52,55,56], reduction in diabetic induced haematologic effects [56],antibacterial potential [57] and wound healing properties [58] and therefore aid in controlling muscle wasting [59] and finally results in weight gain..

Conclusion

Dietary factors play a key role in the prevention and treatment of diseases. Meat based meals has a lot of pitfalls and the intake should be minimized. Therefore, vegetable based meals is the ideal meal and should be advocated for all for a prolonged lifespan.
Acknowledgement

The authors are grateful to all staff of the Department of Pharmacology, University of Calabar, Calabar, Cross River State, Nigeria for their technical assistance.

Financial support: None declared

Conflict of Interest

Authors declare that there is no conflict of interest to reveal

References


Advances in Biomedicine and Pharmacy Vol. 3 (2) 2016


