Food Chemistry 140 (2013) 458–465

Contents lists available at SciVerse ScienceDirect

Food Chemistry

journal homepage: www.elsevier.com/locate/foodchem

The nutrient composition of three cuts obtained from P-class South African pork carcasses

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ARTICLE INFO

Article history:
Available online 16 November 2012

Keywords:
Nutrient composition
South African pork
Leg
Loin
Shoulder cuts

ABSTRACT

The shoulder, loin and leg from P-class pork carcasses were used to determine the nutrient composition of both raw and cooked cuts. Significantly lower fat content were observed in the current study for the leg (5.21 g/100 g) and loin (6.99 g/100 g) compared to the shoulder cut (10.32 g/100 g). The overall percentage fat for all three cuts was less than 10% which is recommended by the South African Heart Mark. The cooked loin cut contained the most protein (27.50 g/100 g) of the three cooked cuts. When compared to other meat products (beef, mutton and chicken) it is clear that pork is a good source of B vitamins, especially vitamin B_3. The cooked loin cut contained the least vitamin B_1 (0.22 mg/100 g), B_2 (0.02 mg/100 g) but the most vitamin B_3 (7.09 mg/100 g), of the three cooked cuts. The 100 g cooked shoulder, loin and leg cuts provide on average 40.11% protein, 5.19% magnesium, 3.37% calcium, 24.29% phosphorus, 18.22% zinc, 22.33% iron and 22.50% vitamin B_1, 2.57% vitamin B_2 and 42.6% vitamin B_3 of Recommended Daily Allowances for males, age 25–50. Energy from a 100 g portion provides 5.81% of the Recommended Daily Allowances. To conclude, the pork cuts are undoubtedly a good source of nutrients that is required for good health because it is high in protein, have a low fat content and are a nutrient-packed choice for the family and compares favourably with the fat, energy, and cholesterol content of many other meats and poultry.

> "A knowledge of the chemical composition of foods is the first essential in dietary treatment of disease or in any quantitative study of human nutrition" – McCance & Widdowson, 1940.

1. Introduction

As in many other countries, South Africa is actively involved in analysing foods for the compilation of food composition data. Currently, only 37% of all South African food values in the Medical Research Council's (MRC) tables are derived from South African foodstuffs (SAFOOD, 2011). The current data on pork that appear in the MRC's food composition tables of 1999 are derived from the United States Department of Agriculture (USDA) database (Sayed, Frans, & Schönfeldt, 1999).

In 2008, the need for information on the quality of South African pork to address consumer uncertainties was identified by the Red Meat Producers Organisation (RPO) as being of prime importance, following similar studies in Australia by the Meat and Livestock Australia (MLA). They subsequently requested that the quality of South African pork be investigated. In 2004, the study was undertaken by the Agricultural Research Council – Animal Nutrition and Animal Products Institute (ARC – ANPI). The aim was to determine the nutrient content of South African pork (P-class).

Presently there is very little authentic and scientific information available on the nutrient content of South African pork which may be used for dietary guidelines. Although it can be accepted that all commercial South African pigs originated from international breed stock, their nutrient information will not necessarily be similar. International research from Australia and the United States showed that each county has different nutrient values when food products are analysed. The differences in the cutting up of the carcasses between the various countries additionally, make the interpretation of results difficult (Greenfield & Southgate, 2003). Pigs in South Africa are slaughtered according to a different classification system (at different weights for example the P-class in PORCUS is: 81–90 kg and <12 mm fat thickness) than in the other mentioned countries such as Canada (FCC, 2011), USDA, (USDA, 2012), UK and Ireland (Dunbia., 2012), which limit the utilisation of their results, as the weight of the carcass has a direct influence on the nutrient content. Differences in climate, feed types and processing methods as well as the water composition in South Africa, also affect the nutrient content (specifically the minerals and vitamins) of

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http://dx.doi.org/10.1016/j.foodchem.2012.10.066

the animal feed as well as the production of vitamin D in the meat itself.

Meat and meat products are nutrient dense food and an important source of a wide range of valuable nutrients such as proteins, fat, vitamins and minerals as well as some micronutrients, all of which are essential for good health (Verbeke, Pérez-Cueto, & Gruner, 2011). According to Visser (2004), pork is the number one source of animal protein in the world and furthermore, can be regarded as a good source of iron, zinc as well as almost all the B-vitamins, especially thiamin.

As a result of the improvement of people's living standards and development of commodity economy, the consumer has a higher demand on nutritional value, colour and taste, specifically that of pork meat (Liu et al., 2009). This could be one of the reasons why the consumption of South African pork increased from 3.5 kg (2000) to over 4.2 kg in 2010 (Streicher, 2012).

Although high intakes of some animal products are associated with increased fat consumption and may lead to weight gain (Givens, 2005), Enser (2000) emphasised the numerous nutritional benefits associated with lean meat. Fat associated with the consumption of red meat may increase the risk for colon cancer as it promotes the excretion of bile which can be converted to carcinogens (Biesalski, 2005), but nevertheless, red meat holds numerous health benefits for the human body. The amount of fat in the carcass and muscle influences the fatty acid composition and thus the healthfulness of the meat (Wood et al., 2008). The role of conjugated linoleic acid (CLA) in the prevention and possible treatment of several diseases such as cancer has become evident over the last decade (Decker & Park, 2010; McGuire & McGuire, 1999) and research in this field has become more popular. Conjugated linoleic acid isomers appear to modulate cancer, body composition, body weight, immune function and glucose metabolism in experimental models (Whigham, Cook, & Atkinson, 2000).

As the incidence of chronic diseases also continues to increase, the consumer's interest in the positive role of food is growing. In an article by Kittel (2006), there was referred to a study published in the journal – *Obesity*, that by including protein from lean sources of pork in the diet, could help to retain more lean body mass, including muscle, while losing weight. For good health, the USDA Dietary Guidelines for Americans recommends consuming 20–35% of ones kilojoules intake as fat and less than 10% of these kilojoules as saturated fat by selecting foods that are lean or low-fat. The guidelines for cholesterol remain the same for everyone, namely less than 300 mg per day.

Schönfeldt (2003) mentioned that the focus of individuals is moving from efforts to optimise balanced nutrition to improve their health, resulting in the concept of "food today for medicine tomorrow". Although, a worldwide trend for leaner and healthier meat is growing exponentially, it is important for the consumer to know the risks and adopting a healthy lifestyle for a healthy heart. Certain scientific nutritional information is needed to promote leaner meat and in this context, The South African Heart Foundation (S.a.) has set an upper limit for fat, fatty acids and cholesterol. Through changes in feeding and breeding techniques, pork producers have responded to consumer demand for leaner pork. Today's pork has 16% less fat and 27% less saturated fat than 15 years ago. Many cuts of pork are as lean as skinless chicken (Kittel, 2006).

The only analysed data on pork, currently available in South Africa, is the chemical analysis on raw pork loin by Pieterse (2005). From these results it is clear that, although the protein content is similar, the fat content is markedly lower than the values quoted in the current Food Composition Tables published by the MRC and widely utilised by dieticians and medical practitioners. With the correct interpretation of the composition of new analysed South African pork data, the nutrient content of pork can be used effectively to address the negative health image that pork has in the minds of firstly medical practitioners, dieticians and health workers and secondly, but most importantly, the consumer.

Therefore, the ability to promote the nutritional attributes of South African pork to the consumer is considered important to improve the health-related perceptions of pork. The information will also be of significance towards meeting the requirements of the South African Heart Foundation. In this context, one is encouraged by the results of Pieterse (2005) which support the opinion that South African pork (5 mm fat) will probably meet the SA Heart Foundation standard, but a thorough analysis is nevertheless of paramount importance. The objective of the study was, to determine the nutrient composition of raw (fresh, not frozen) and cooked meat and fat samples from three pork cuts (leg, loin and shoulder) obtained from P-class (81–90 kg carcasses with 70% meat and more, with a fat thickness measured by means of an intrascope of at least 1 mm but not more than 12 mm fat, (National Department of Agriculture (NDA), 1990) South African pork carcasses, in order to incorporate the data into the Food Composition Tables of the Medical Research Council of South Africa to be used by the medical fraternity to make meaningful recommendations to the consumer.

2. Materials and methods

The Department of Agriculture was approached to assist the ARC – API in the collection of the samples. The selection of random carcasses and cuts cut ($n = 3$ shoulder, 3 leg and 3 loin cuts) were based on the fact that pigs are drawn from the main production areas which supply the main abattoirs and therefore are representative. However, due to financial constraints, only limited cuts were analysed for nutrient content. The meat samples comprised of the most commonly consumed carcasses in South Africa namely the P-class carcasses (81–90 kg) with 70% meat and more, with a fat thickness measured by means of an intrascope of at least 1 mm but not more than 12 mm. According to the Agricultural Product Standards ACT No. 119 of 1990 (NDA, 1990), the South African classification system is designed to describe carcasses according to tissue composition.

The pigs were slaughtered using standard commercial procedures. The carcasses were sectioned down the vertebral column with a band saw and then subdivided into the following nine wholesale cuts: belly, breast (shoulder), rib, loin, chump, thick rib, shank and trotter and leg. Three cuts, (shoulder, loin and leg) from the right sides of the carcasses were used to determine the raw nutrient composition (duplicate) and the left sides were used to determine the cooked nutrient composition (duplicate) for each of the three cuts. After selection of the three cuts, they were transported in a refrigerated truck (4–6 °C) to the Meat Industry Centre of the Livestock and Business Division: (ARC – ANPI), Irene. Upon arrival all the cuts were chilled at 4 °C overnight and dissected the following day. The cuts from the left sides were vacuum-packed and frozen, at −20 °C until the cooking process to determine the cooked nutrient composition commenced. The assumption, as confirmed by Kirton, Barton, and Rae (1962) is that the composition of either side of the carcass is similar.

2.1. Sample preparation – Sampling cuts from the right sides (raw) and left sides (cooked)

A trained deboning team was responsible for the physical dissection of the raw pork cuts (shoulder, loin and leg) from the right sides into three portions namely meat (muscle + intramuscular