CHANGES IN THE NUTRIENT CONTENT OF SOUTH AFRICAN RED MEAT

Nicolette Hall[1], and Hettie C. Schonfeldt[1]

[1]Department of Animal and Wildlife Sciences, University of Pretoria, Pretoria, South Africa

Abstract - The red meat industry has responded to the ever escalating obesity epidemic and the increased awareness of the role of food choices on health and nutrition, by reducing the amount of fat found on red meat carcasses. Further removal of fat through trimming practices has resulted in an even leaner product. Up to date scientific data on the nutrient content of red meat is required to align consumer education projects and to assess the role which red meat can play in today's healthy, balanced diet. Recent projects on the nutrient content of South African red meat (beef, lamb and mutton) has found that fat content of red meat has decreased on average to less than 15g/100g edible product prior to trimming, and to 10% after trimming of subcutaneous fat. Further removal of visible fat reduces the fat content of South African red meat to less than 5% on average.

Key Words – beef, fat content, lamb, mutton, nutrient density

I. INTRODUCTION

Nearly 60%, and steadily increasing, of the South African (SA) adult population is overweight or obese [1]. Based on epidemiological studies, obesity has a positive association with high saturated fat intake from foods from animal origin [2], this is in spite of the fact that red meat is recognized as a primary dietary component and forms an important part of a balanced and varied diet. Due to the increased awareness of the role of food choice in the global obesity epidemic, red meat is often seen as a culprit in weight gain. In line with international food consumption patterns, SA consumers are consuming more white meat today in favor of red meat.

Globally, the meat industry has responded to the current health and nutrition trends by decreasing the total fat content of red meat. Actions to reduce fat content include breed selection, feed manipulation, and retail and food preparation practices, such as trimming.

In order to reflect true composition with changes in carcass characteristics as well as retail and food preparation practices, nutrient data should continually be updated. Various studies around the globe reflect the changes in the composition of carcass meat, especially a reduction in the amount of total fat [3]. In South Africa the average fat content of target grade beef has decreased from 32% in 1949 [4] to 18% in 1981 [5] to 13% in 1991 [6]. Reducing fat content through trimming has, in global studies, reflected fat content values of less than 10% [3]. Further reduction in fat content at home, including trimming, cooking loss and plate waste, has indicated that lean red meat can contain less than 5% fat [3].

The nutrient content of SA lamb and mutton with and without subcutaneous fat was recently determined as no local data previously existed [7;8]. The composition of SA beef with subcutaneous fat removed has never been determined, and a current running project aims to determine the nutritional profile of beef from four age groups, with and without subcutaneous fat.

The relevant up-to-date composition data on SA red meat enables the extrapolation of the effect of age on the composition, and the effect which trimming has on carcass composition. Not only will a reduction in fat content result in lower contribution of fat and energy per 100g product, but also increase the amount of other essential nutrients such as protein, iron and B-vitamins per 100g product (nutrient density). Accurate composition data on lean red meat (trimmed) enables consumer education, in line with current nutrimarketing trends, to further the image of South African red meat as part of a healthy diet.

II. MATERIALS AND METHODS

Sampling

The sampling plans for each project were developed to ensure that nutrient data generated are representative and accurate, while simultaneously considering financial constraints.

Carcass selection

For sheep meat, within each age group (lamb (0 incisors) and mutton (>6 incisors)), three Mutton Merino carcasses and three Dorper carcasses were pooled from three different production regions in SA. A total of 18 carcasses were obtained per age group.

Nine Bonsmara carcasses within each of three age groups of beef were included in the study (age AB with 1 to 2 incisors, age B with 2 to 6 incisors, and age C with more than 6 incisors).

All animals were slaughtered and dressed using standard commercial procedures. Carcasses were sectioned down the vertebral column, and subdivided into the primal carcass cuts. An experienced deboning team was responsible for the physical dissection of the carcasses. For sheep meat, the shoulder, loin and leg and for beef, the shoulder, prime-rib and rump, were analysed for nutrient content. These cuts were selected as they represent the composition of the carcass the best [6].

Sample preparation

Dissection took place in an environmentally controlled de-boning room (10°C). The cuts were weighed and dissected into muscle, intramuscular fat, subcutaneous fat, and bone. Each fraction was weighted and recorded, and used to calculate carcass composition. After nutrient analysis, carcass composition was used to calculate nutrient content of various portions (Table 1).

Meat and fat fractions from three similar cuts were grouped together as composite samples which were cubed, minced (5mm and then 3mm mesh plate) and frozen as 300g vacuum sealed samples. Meat samples and fat samples were freeze dried and sent for nutritional analysis at the Agricultural Research Council (ARC) Analytical Laboratory.

Table 1: Calculating nutrient composition

Portion description	**Fractions**
As purchased	Bone + muscle + intermuscular fat + subcutaneous fat
Edible portion	Muscle + intermuscular fat + subcutaneous fat
Lean edible portion	Muscle + intermuscular fat
Muscle only	Muscle

Analytical procedures

All analytical procedures were performed on a double-blind base in SANAS (South African National Accreditation Services) accredited laboratories. In Table 2 the methods are summarized. Vitamins were determined but not reported in this study.

Table 2: Methods for analyses

Analysis	**Method**
Moisture	Official Method 935.29 [9]
Total Nitrogen	Official Method 992.15 [9]
Fat	Official Method 960.39 [9]
Minerals	Inductive Coupled Plasma-Optical Emission Spectrometry – ICP-OES
Fatty acid profile	Gas Chromatography
Cholesterol	Dole Extraction-Gas Chromatography

III. RESULTS AND DISCUSSION

In Tables 3 and 4 the nutrient content of lamb, in Table 5 and 6 mutton, and Table 7 to 9 beef is presented.

Table 1: The nutrient content of 100g raw edible portion SA lamb (muscle, intermuscular- and subcutaneous fat)

Nutrient		Shoulder	Loin	Leg
Moisture	g	67.9	65.2	70.2
Energy	kJ	777	905	682
Protein	g	17.4	16.8	18
Cholesterol	mg	65.2	64	64.1
Fat	g	13	16.7	10.2
Total FA	g	12	14.5	8.96
SFA	g	6.38	7.82	4.67
MUFA	g	5.22	6.19	3.97
PUFA	g	0.44	0.51	0.32
Iron	mg	1.12	1	1.59
Magnesium	mg	16.2	16.6	20.1
Potassium	mg	187	287	325
Sodium	mg	63.4	66.1	64.6
Zinc	mg	1.86	1.31	2.51

Table 2: The nutrient content of 100g raw edible portion of SA lamb (muscle and intermuscular fat)

Nutrient		Shoulder	Loin	Leg
Moisture	g	70.8	70.1	73.7
Energy	kJ	662	718	545
Protein	g	18	17.8	18.7
Cholesterol	mg	64	61.8	62.7
Fat	g	9.63	11.3	6.15
Total FA	g	9.03	9.55	5.36
SFA	g	4.84	5.29	2.82
MUFA	g	3.85	3.9	2.34
PUFA	g	0.34	0.36	0.21
Iron	mg	1.20	1.13	1.71
Magnesium	mg	17.4	18.7	21.6
Potassium	mg	201	323	351
Sodium	mg	67.9	74.4	69.7
Zinc	mg	1.99	1.48	2.71

Table 3: The nutrient content of 100g raw edible portion of SA mutton (muscle, intermuscular- and subcutaneous fat)

Nutrient		Shoulder	Loin	Leg
Moisture	g	67.2	62.5	69.7
Energy	kJ	813	998	730
Total N	g	2.99	2.84	3.04
Protein	g	18.7	17.7	19
Cholesterol	mg	51.2	50.1	49.6
Fat	g	13.4	18.8	11
Total FA	g	12.5	17.7	10.1
SFA	g	6.83	9.91	5.23
MUFA	g	5.24	7.21	4.47
PUFA	g	0.48	0.59	0.38
Iron	mg	2.18	2.32	2.8
Magnesium	mg	18.6	18.1	20.5
Potassium	mg	227	224	253
Sodium	mg	74.0	67.9	67.2
Zinc	mg	3.93	2.56	3.15

Table 4: The nutrient content of 100g raw lean muscle only portion of SA mutton (muscle and intermuscular fat)

Nutrient		Shoulder	Loin	Leg
Moisture	g	69.8	68.6	72.9
Energy	kJ	703	746	589
Total N	g	3.07	3.07	3.18
Protein	g	19.2	19.2	19.9
Cholesterol	mg	49.8	49.8	47.7
Fat	g	10.2	11.4	6.77
Total FA	g	9.46	10.6	6.08
SFA	g	5.08	5.83	3.05
MUFA	g	4.01	4.4	2.78
PUFA	g	0.37	0.38	0.25
Iron	mg	2.34	2.65	3.02
Magnesium	mg	20	20.7	22.1
Potassium	mg	244	255	274
Sodium	mg	79.4	77.5	72.6
Zinc	mg	4.22	2.92	3.4

Table 5: Selected nutrients found in 100g muscle portion of South African beef (age AB with 1 to 2 incisors)

Nutrient		Shoulder	Prime rib	Rump
Moisture	g	75.59	73.35	74.38
Protein	g	20.62	22.13	22.45
Fat	g	2.98	3.82	1.92
Iron	mg	2.15	2.23	3.38
Magnesium	mg	21.8	24.7	26.7
Potassium	mg	0.17	0.18	0.21
Calcium	mg	4.34	6.80	3.67
Copper	mg	0.07	0.03	0.07
Zinc	mg	4.02	3.89	3.25
Manganese	mg	0.01	0.01	0.03
Selenium	mcg	12.8	10.8	14.1

Table 6: Selected nutrients found in 100g muscle portion of South African beef (age B with 2 to 6 incisors)

Nutrient		Shoulder	Prime rib	Rump
Moisture	g	75.39	71.84	74.45
Protein	g	20.69	22.42	21.86
Fat	g	3.16	4.87	2.54
Iron	mg	2.18	2.35	2.56
Magnesium	mg	22.9	34.3	29.1
Potassium	mg	0.17	0.18	0.19
Calcium	mg	4.09	5.84	3.36
Copper	mg	0.07	0.04	0.07
Zinc	mg	3.82	3.99	3.14
Manganese	mg	0.02	0.02	0.02
Selenium	mcg	10.4	10.2	11.7

Table 7: Selected nutrients found in 100g muscle portion of South African beef (age C with more than 6 incisors)

Nutrient		Shoulder	Prime rib	Rump
Moisture	g	73.58	71.50	73.68
Protein	g	20.59	21.10	21.81
Fat	g	4.85	6.39	3.25
Iron	mg	2.17	2.28	2.33
Magnesium	mg	24.5	23.4	25.8
Potassium	mg	0.18	0.18	0.20
Calcium	mg	4.31	6.42	3.82
Copper	mg	0.09	0.05	0.08
Zinc	mg	4.15	3.68	3.22
Manganese	mg	0.01	0.01	0.01
Selenium	mcg	6.18	6.20	7.87

The studies have found that the fat content of SA red meat is significantly less than what was previously reported in the national food composition reference tables. In line with global trends, the fat content of SA red meat has decreased from nearly a third of the carcass composition in the 1950’s to 10% of the edible portion of lean meat [7;8], and less than 5% when all visible fat is removed (Figure 1).

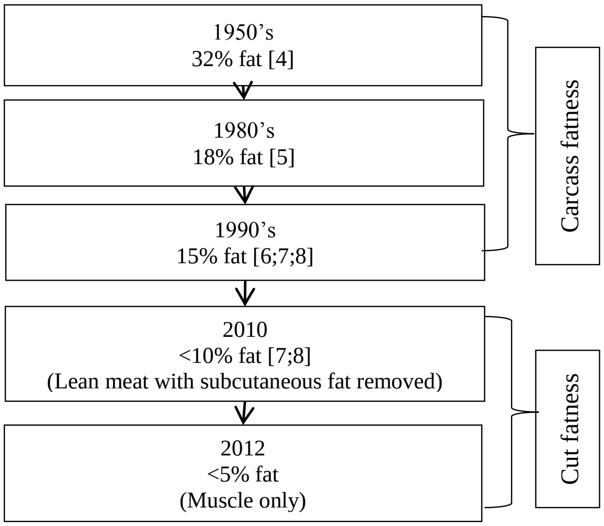

Figure 1: Changes in the fat content of South African red meat

IV. CONCLUSIONS & RECOMMENDATIONS

Red meat plays an important in the diet of most South Africans as is often regarded as the central food around which meals are planned. The nutrient content of SA red meat has changed dramatically over time. The fat content of red meat has decreased from more than 30%, to less than 5% if visible fat is removed. This substantial decrease in fat content of red meat not only decreases the amount of total and saturated fat which the product contributes to the human diet, but also impacts on the nutrient density of the food as fat dilutes other essential nutrients, e.g protein and iron. These nutrients are often in short supply in the diets of many people from developing countries such as SA.

The updated nutrient content data can be used to assess the actual impact which red meat consumption has on the nutrition and health status of the population, and enable realignment of consumer education projects, update food-based dietary guidelines, and formulate policy aimed at combating overweight and obesity while simultaneously aiming to improve the nutritional quality of the populations' diet.

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