Nutrient content of lamb and mutton offal

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The nutritional composition of South African lamb and mutton offal

Industry Sector: Cattle and Small Stock

Research focus area: Red Meat Safety, Nutritional Value, Consumerism and Consumer Behaviour

Research Institute: University of Pretoria

Researcher: Dr JL du Toit

Title	Initials	Surname	Highest Qualification
Prof	HC	Schönfeldt	PhD
Ms	C	Muller	MSc
Dr	N	Hall	PhD
Ms	M	Bester	MSc
Ms	D	Human	Matric

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Aims of the project

- To determine the nutritional composition of South African lamb and mutton offal products (raw and cooked)
- To determine yield, retention and physical composition of the different cooked offal products to ultimately determine the edible portion of each product
- To incorporate the nutritional composition data and physical composition data into the national food composition tables as well as the food quantities manual of the Medical Research Council

Executive Summary

Offal, also called variety meats, or organ meats or the ”fifth quarter”, have been overlooked in the past in dietary guidelines and recommendations, irrespective of their potential contribution to food and nutrition security. This study focussed on understanding the

physical and nutrient composition, as well as the potential nutritional contribution of lamb and mutton offal, when used in the correct amounts, to South African diets.

Significant amounts of protein, iron and zinc (three nutrients of concern in South Africa) can be found in selected organ meats which compared favourably with beef and lamb muscle meat cuts. The most significant findings of the study were the high levels of protein (>10g/100g) found in all cooked lamb and sheep offal cuts ranging from 14.26g/g (cooked lamb intestines) to 32.6g/100g (cooked sheep kidneys). High levels of total iron were found in cooked sheep lungs (TFe=10.73mg/100g); cooked sheep spleen (TFe=11.71mg/100g); cooked sheep liver (TFe=7.95mg/100g) cooked lamb lungs (TFe=8.368mg/100g) and lamb spleen (TFe=22.83mg/100g).

Instead of simply focussing on total protein, attention has shifted to the greater importance of protein quality than actual quantity, emphasising the presence of individual amino acids in a food. Protein quality answers two important questions namely, how much protein as well as what kind of protein should be consumed. Dietary proteins are classified as either being complete or incomplete. Foods containing all essential amino acids (indispensable amino acids) are referred to as a complete protein. The sum of the essential amino acids for lamb and mutton offal varies between 4.2 g/100g and 8.1 g/100g for mutton tongue and liver respectively. The study found that South African lamb and mutton offal adheres to the requirements as set out by the Department of Health to be labelled and proclaimed as a complete, quality protein.

Offal products contribute consistently to the diet not only in terms of essential fatty acids such as linoleic acid (C18:2n-6) and arachidonic acid (C20:4 n-6), but also eicosanoic (arachidic) acid (C20) and docosanoic acid (C22) polyunsaturated fatty acids. Ruminant meats and oily fish are the only significant sources of preformed and C22 PUFA in the diet (Enser, et al., 1998; Wyness, et al., 2011). Although human beings have the metabolic capacity to synthesize C20 and C22 fatty acids from the n-6 or n-3 precursors of linoleic and α-linolenic acid respectively, an increase in the consumption of C20 and C22 n-3 polyunsaturated fatty acids could overcome the perceived imbalance in the ratio of n-6:n-3 polyunsaturated fatty acids in modern diets.

Based on the results of this study South African lamb and mutton offal cuts can be considered a good source of protein and also a nutrient dense food source. Due to the current state of nutrition in South Africa such foods are important commodities and the promotion thereof should be prioritised.

Popular Article

Nutrient density lamb and mutton offal

[1]Pretorius, B., [1,2]Schönfeldt, H.C. and [1]Bester, M.

[1]Department of Animal and Wildlife Sciences, Institute of Food, Nutrition and Well-being. University of Pretoria. South Africa

[2]Professor and Director: ARUA Centre of Excellence: Food Security

Despite economic growth, undernutrition and food insecurity remain today at unacceptably high levels, while at the same time, diet-related non-communicable diseases (cardiovascular diseases, diabetes and hypertension) have exponentially increased to become the leading cause of mortality worldwide. The situation is set to worsen dramatically in the near future as powerful drivers of change such as population growth, climate change and urbanization converge on food systems. Consumption recommendations for high quality nutrient dense foods such as animal source foods (ASFs) are of utmost importance and should be adhered to, to keep up with the specific physiological demands of each life stage. However it was found that the feasibility for nutritionally vulnerable individuals in South Africa to adhere to these recommendations seems unlikely. The dire economic climate which South Africans, particularly those of low socio economic status, currently have to face, is probably the main reason for the problem that nutritionally vulnerable individuals cannot meet the recommendations of the Food-based Dietary Guidelines for South Africans.

Offal has been overlooked in the past in dietary guidelines and recommendations, irrespective of their potential contribution to food and nutrition security in South Africa. Limited information is available on the composition of South African lamb and mutton organ meats as cooked and consumed at home. This study focussed on understanding the physical and nutrient composition, as well as the potential nutritional contribution of lamb and mutton offal, when used in the correct amounts, to South African diets.

Table 1: Moisture, fat and protein content of 100g edible portion cooked lamb & mutton offal

	Lamb			**Mutton**		
n=3	**Moisture**	**Protein**	**Fat**	**Moisture**	**Protein**	**Fat**
	g/100g	**g/100g**	**g/100g**	**g/100g**	**g/100g**	**g/100g**
Intestines	**55.2^{cd}**	**14.3^{d}**	**31.2^{a}**	**48.2^{d}**	**15.3^{d}**	**37.9^{a}**
Lungs	**74.1^{a}**	**21.1^{bc}**	**6.53^{b}**	**71.1^{a}**	**23.2^{bc}**	**3.97^{d}**
Hearts	**65.1^{b}**	**19.3^{cd}**	**13.5^{b}**	**57.6^{bc}**	**20.4^{cd}**	**20.2^{c}**
Livers	**61.2^{bc}**	**23.6^{bc}**	**8.39^{b}**	**64.5^{ab}**	**23.1^{bc}**	**6.27^{d}**
Stomachs	**49.6^{d}**	**24.8^{ab}**	**29.9^{a}**	**53.1^{cd}**	**17.8^{d}**	**27.3^{bc}**
Kidneys	**65.8^{b}**	**24.4^{abc}**	**12.1^{b}**	**57.2^{bcd}**	**32.7^{a}**	**7.77^{e}**
Spleen	**67.1^{ab}**	**29.5^{a}**	**6.62^{b}**	**66.2^{ab}**	**27.8^{ab}**	**5.23^{e}**
Tongues	**63.7^{b}**	**19.2^{cd}**	**16.8^{b}**	**52.6^{cd}**	**15.8^{d}**	**33.2^{ab}**
P-value	***<0.001***	***<0.001***	***<0.001***	***<0.001***	***<0.001***	***<0.001***

Note: Means with different superscripts in a column differ significantly

Table 2: Mineral content of 100g edible portion cooked lamb offal

	Ca	**P**	**Mg**	**Cu**	**Fe**	**Zn**	**K**	**Na**

n=3	mg/100g	mg/100g	mg/100g	mg/100g	mg/100g	mg/100g	mg/100g	mg/100g
Intestines	**18.6^{b}**	**124^{e}**	**21.9^{a}**	**0.28^{b}**	**1.40^{c}**	**2.60^{c}**	**75.1^{d}**	**38.4^{f}**
Lungs	**8.90^{b}**	**271^{c}**	**22.2^{a}**	**0.46^{b}**	**8.37^{b}**	**2.59^{c}**	**298^{b}**	**160^{b}**
Hearts	**5.12^{b}**	**195^{d}**	**29.0^{a}**	**0.49^{b}**	**3.84^{bc}**	**2.49^{c}**	**261^{b}**	**101^{cd}**
Livers	**5.03^{b}**	**423^{a}**	**28.3^{a}**	**17.9^{a}**	**6.07^{bc}**	**4.17^{a}**	**315^{b}**	**70.8^{e}**
Stomachs	**52.7^{a}**	**170de**	**25.3^{a}**	**0.40^{b}**	**4.85^{bc}**	**3.90^{a}**	**155^{c}**	**79.5^{de}**
Kidneys	**9.38^{b}**	**330^{b}**	**30.6^{a}**	**0.53^{b}**	**4.44^{bc}**	**3.67^{a}**	**310^{b}**	**234^{a}**
Spleen	**7.57^{b}**	**406^{a}**	**30.8^{a}**	**0.29^{b}**	**22.8^{a}**	**3.60^{ab}**	**409^{a}**	**112^{c}**
Tongues	**17.7^{b}**	**184^{d}**	**24.0^{a}**	**0.31^{b}**	**1.50^{bc}**	**2.83^{ab}**	**276^{b}**	**102^{cd}**
P-value	**<0.001**	**<0.001**	**0.132**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**

Note: Means with different superscripts in a column differ significantly

Table 3: Mineral content of 100g edible portion cooked mutton offal

	Ca	P	Mg	Cu	Fe	Zn	K	Na
n=3	**mg/100g**	**mg/100g**	**mg/100g**	**mg/100g**	**mg/100g**	**mg/100g**	**mg/100g**	**mg/100g**
Intestines	**16.6^{b}**	**112^{c}**	**16.9^{cd}**	**0.15^{b}**	**1.69^{e}**	**2.55^{b}**	**50.2^{d}**	**29.5^{e}**
Lungs	**11.0^{bc}**	**250^{b}**	**19.4^{bcd}**	**0.41^{b}**	**10.7^{a}**	**2.62^{b}**	**285^{bc}**	**190^{b}**
Hearts	**6.00^{c}**	**223^{b}**	**24.8^{ab}**	**0.65^{b}**	**4.54^{c}**	**2.74^{b}**	**275^{bc}**	**97.5^{cd}**
Livers	**5.60^{c}**	**399^{a}**	**26.2^{ab}**	**31.87^{a}**	**7.96^{b}**	**4.38^{a}**	**326^{bc}**	**78.7^{cde}**
Stomachs	**24.6^{a}**	**112^{c}**	**15.9^{d}**	**0.25^{b}**	**2.70^{de}**	**3.37^{ab}**	**104^{d}**	**58.7^{de}**
Kidneys	**15.6^{b}**	**400^{a}**	**30.7^{a}**	**0.56^{b}**	**4.34^{cd}**	**4.49^{a}**	**279^{bc}**	**270^{a}**
Spleen	**6.00^{c}**	**414^{a}**	**31.4^{a}**	**0.15^{b}**	**11.7^{a}**	**3.61^{ab}**	**472^{a}**	**112^{cd}**
Tongues	**8.70^{c}**	**142^{c}**	**23.3^{bc}**	**0.20^{b}**	**1.81^{e}**	**2.91^{b}**	**235^{c}**	**122^{c}**
P-value	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**

Note: Means with different superscripts in a column differ significantly

Table 4: Contribution to NRV's and nutrient content claims per 90g cooked offal meat
[I] *NRV according to the Foodstuffs, Cosmetics and Disinfectants act* (DOH, 2014)

	Protein	Calcium	Phosphorus	Magnesium	Iron	Manganese	Zinc	Potassium	Sodium
NRV[I]	56g	1300mg	1250mg	365mg	13mg	2.3mg	10mg	4700mg	2000mg
Mutton	% of NRV per 90g serving[II III]								
Intestines	25[IV]	11	8	0	12	0	23 [IV]	1	1
Lungs	37[v]	7	18 [IV]	0	74 [VI]	0	24 [IV]	5	9

Hearts	33[v]	0	16 [IV]	0	31[v]	0	25 [IV]	5	4
Livers	37[v]	0	29 [IV]	0	55[v]	0	39[v]	6	4
Stomachs	29 [IV]	2	8	0	19 [IV]	0	30[v]	2	3
Kidneys	52[v]	1	29 [IV]	0	30[v]	0	40[v]	5	12
Spleen	45[v]	0	30[v]	0	81 [VI]	0	32[v]	9	5
Tongues	25[IV]	1	10	0	13	0	26 [IV]	4	5
Lamb	% of NRV per 90g serving[II III]								
Intestines	23[IV]	1	9	0	10	0	23 [IV]	1	2
Lungs	34[v]	1	19 [IV]	0	58[v]	0	23 [IV]	6	7
Hearts	31[v]	0	14	0	27 [IV]	2	22 [IV]	5	5
Livers	38[v]	0	30[v]	0	42[v]	10	38[v]	6	3
Stomachs	40[v]	4	12	0	34[v]	8	35[v]	3	4
Kidneys	39[v]	1	24 [IV]	0	31[v]	2	33[v]	6	11
Spleen	47[v]	1	29 [IV]	0	158[VI]	0	32[v]	8	5
Tongues	31[v]	1	13	0	10	0	25 [IV]	5	5

II *90g is the prescribed portion size for lean meat according to the Food-based dietary guidelines for South Africans* (Schönfeldt, Pretorius, & Hall, 2013)

III *Values do not take bioavailability into account*

IV *" Source of" as per the Foodstuffs, Cosmetics and Disinfectants act (DOH,2014)*

v *"" High in" as per the Foodstuffs, Cosmetics and Disinfectants act (DOH,2014)*

VI *" Excellent source" as per the Foodstuffs, Cosmetics and Disinfectants act (DOH,2014)*

South African lamb and mutton offal can be considered a good source of protein and a nutrient dense food. In the case of protein, zinc and iron, three nutrients of concern in South Africa, all lamb and mutton organ meats were at least a source of two out of these three nutrients with lamb and mutton spleens and lamb and mutton lungs being excellent sources of protein. In view of the current disturbing state of nutrition in South Africa, as well as efforts to reduce food waste, lamb and mutton organ meats were found to be important food commodities and it was suggested that the promotion of offal should be prioritised.

Quantitative food data goes hand in hand with the nutrient composition tables used in a given country, because it provides supporting information on the food items included in the nutrient composition tables. Good quality nutrient composition and quantitative food data play an integral role in reporting the nutrient intake of a population, as well as interpreting results of certain epidemiological research. A new set of quantitative data on the nutrient

and physical composition (meat, bone and fat fractions) and yield of different offal cuts were generated to assist researchers in collecting more precise, product specific data to measure nutrient in South African food consumption studies.

Please contact the Primary Researcher if you need a copy of the comprehensive report of this project – Beulah Pretorius on beulah.pretorius@up.ac.za