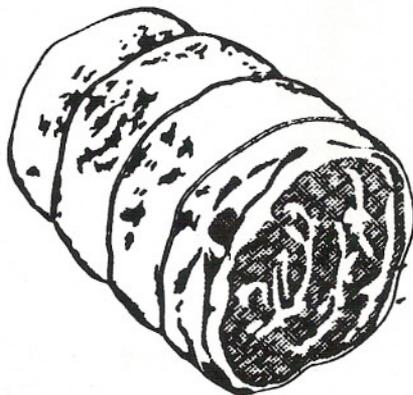


QUALITY ASSESSMENT OF REINDEER MEAT



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Introduction

Historically, sales of exotic meats have been limited only by supply. As supply has increased in recent years, national and international exotic game markets have grown rapidly. In the United States, growth has occurred primarily in the restaurant section, although over-the-counter sales have also increased.

The Alaskan reindeer industry is exploring the potential of expanding its meat sales as well as antler sales. Meat production increased from 320,000 pounds in 1987 to 432,000 pounds in 1988. This production increase is reflected in a 27 percent increase in dollar value (Alaska Crop and Livestock Reporting Service, 1989). Under current management procedures, potential meat production has been estimated at 500,000 pounds (Pearson and Lewis, 1988). Any future market expansion is likely to occur in urban Alaska and in areas outside the state (Jones, 1988).

Evidence exists that some consumers are willing

to pay premium prices for reindeer. In one speciality meat market, New Yorkers paid \$14.97 per pound in 1987. Prices of reindeer in speciality food catalogs range from \$12.00 to \$45.00 per pound (Jones, 1988). Consumers are placing less emphasis than in the past on cost as the primary deciding factor in food purchases. However, these consumers do expect to obtain value for each dollar spent (McNutt, 1988). Value has become synonymous with quality.

Quality has been identified as the major key to success and growth in today's food industry. "If the consumer's demand for quality is not met, loyalty will be transferred to another competitive product" (Martin, 1988). Scandinavian and Canadian reindeer and New Zealand red deer compete with Alaskan reindeer in national and international markets. Thus, successful entry and maintenance of market share will be dependent on the quality characteristics of the Alaskan reindeer meat. Nutritional content and safety are among the quality characteristics that are increasingly important to consumers (McNutt, 1988). Because growth of meat sales beyond the traditional markets in rural Alaska has been hampered by the decreased marketability of the reindeer forequarter (Jones, 1988), this primal (wholesale) cut was used in this study. The forequarter comprises approximately 45 percent of the carcass weight (Zhigunov, 1961).

Materials and Methods

Six representative reindeer forequarters were obtained from commercial sources in March 1989. The forequarters, which had been harvested during the

spring handling on the Seward Peninsula, were shipped under typical conditions to The University of Tennessee for the study. The samples were allowed to thaw for 48 hours at 2 degrees C prior to analyses. Swab tests were conducted to determine the Aerobic Plate Count (APC) on the forequarter surfaces.

Composite samples from the forequarters were analyzed for moisture and fat levels (AOAC, 1984). Approximate protein content was calculated by difference. Fatty acid composition was also determined (AOCS, 1975).

Results and Discussion

Nutritional quality

Nutritional attributes of food products have altered food selection and consumption patterns as evidenced by the decreased consumption of domestic red meats and increased consumption of fish and poultry. Fish and poultry are usually lower in total fat as well as saturated fat content. These changes have been linked to increasing consumer awareness of the relationship between fat consumption and health (Breidenstein, 1988).

Fat, moisture, and protein content of the reindeer forequarters are shown in Table 1; USDA (1975, 1983, 1986) data for similar beef, pork, and lamb cuts are included for comparison. Reindeer had a protein content that ranged from 2.7 to 7.6 percent higher than that reported for domestic red meats. The fat content of the reindeer forequarter varied with retail cut. The shoulder portion had little external fat cover,

Table 1—Composition of soft tissue^a from reindeer and domestic redmeats.

Meat	Moisture (%)	Fat (%)	Protein (%)
<u>Reindeer (lean with fat, raw)^b</u>			
Shoulder muscle	74.72±.12	3.56±.08	22
Composite forequarter cuts ^c	1 70.01±.11	9.15±.06	21
	2 69.21±.46	10.09±.41	21
<u>Beef (lean and fat, raw)^d</u>			
Chuck blade roast (USDA Choice)	58.2	24.4	16.6
Chuck blade roast (USDA Select)	61.1	20.8	17.0
Shortribs (USDA Choice)	48.3	36.2	14.4
<u>Beef (lean only, raw)^d</u>			
Chuck blade roast (USDA Choice)	70.4	9.5	19.2
Chuck blade roast (USDA Select)	71.8	7.7	19.2
<u>Pork (separable lean only, fresh)^e</u>			
Shoulder (whole)	72.1	7.9	19.3
<u>Lamb (lean with fat, raw)^f</u>			
Shoulder	59.6	23.9	15.3
Leg	64.8	16.2	17.8

^aSoft tissue includes lean plus fat. ^bMean ± SD from 2 replicates; samples from Alaskan reindeer forequarters. ^cPrimarily shank and rib soft tissue with small amounts of shoulder meat. ^dFrom USDA, 1986. ^eFrom USDA, 1983. ^fFrom USDA, 1975.

which resulted in a very low fat content and a higher moisture content. The composite samples which included soft tissue taken primarily from the ribs and shank, exhibited a fat content approximately 2.5 times that of the shoulder muscle. These higher fat

samples included the external fat which surrounded the ribs as well as the intramuscular fat present.

Fat content of the domestic red meats differed with species and retail cut. Reindeer shoulder muscle had less fat than did the lean cuts of the beef chuck blade roasts, lean pork shoulder, and lamb cuts. The composite reindeer sample had considerably less fat than did beef chuck with fat and beef short ribs.

The reindeer fatty acid profile (Table 2) revealed lower levels of unsaturated fatty acids than are found in domestic red meat animals (Dugan, 1987). The relative proportion of unsaturated fatty acids was increased when external fat was incorporated. In this composite sample, the reindeer fatty acid composition, like that of the domestic red meat animals, was rich in stearic, palmitic, and oleic acids. Although the shoulder muscle,

Table 2—Percentage of selected fatty acids in reindeer forequarters.

<u>Fatty acid</u>	<u>Reindeer forequarter</u>	
	<u>Shoulder</u>	<u>Composite</u>
14:0	33.5	3.4
16:0	19.7	38.4
16:1	4.1	—
18:0	12.9	23.8
18:0I	4.3	—
18:1	13.1	29.9
18:2	3.7	2.1
18:3	1.5	0.3
20:0	3.0	0.3
20:1	2.2	0.4
22:0	2.0	0.9
22:1	—	0.2
24:0	—	0.1

which contained only intramuscular fat, was also high in these fatty acids, myristic was present in the greatest quantity. Longer chained fatty acids also comprised a greater percentage of the fatty acids present in this lean sample. Among domestic red meat animals, fatty acid composition is influenced by animal age, diet and environment (Dugan, 1987). Similar effects on reindeer fatty acid composition are likely to occur.

Despite the higher saturated fat content of reindeer, consumers who eat reindeer rather than an equal-sized portion of beef, lamb or pork will consume much lower levels of saturated fats due to the lower total fat content. Indeed, the saturated fat content of the reindeer was within the same range reported for poultry and fish (Linscheer and Vergroesen, 1988). Therefore, the inherent nutritional attributes of reindeer should appeal to health-conscious consumers.

Microbiological safety

Safety, particularly microbiological safety, like nutritional content has become an essential quality factor for all foodstuffs (McNutt, 1988). Recently, consumer concerns about the safety of muscle food products have led to the introduction of legislation to require mandatory inspection of seafood as well as domestic red meats and poultry. The exotic animal inspection regulation has also been extended to reindeer. Consumers want some assurance that the product available for purchase is safe and wholesome.

Meat is essentially sterile at the time of slaughter. However, the necessary skinning, evisceration, and cutting exposes the carcass to large numbers of naturally occurring microorganisms. The level of contami-

nation differs with the processing and handling procedures employed (Niven, 1987).

Slaughter of Alaskan reindeer occurs under arctic field conditions. After the reindeer are killed, the carcass is split, and internal organs are removed. Typically, the hide is also removed. The carcass is allowed to hang for one to 12 hours prior to wrapping in gauze for shipment to Nome for final processing and sale. Only the final cutting and sales are completed in an indoor facility.

Aerobic Plate Count (APC), an indication of the degree of contamination present, is reported in Table 3. Low levels of microorganisms were found on the reindeer forequarters (2.34 log APC/in² to 3.39 log APC/in²). These values are considerably lower than the typical range of 4.8 log APC/in² to 7.8 log APC/in² from beef (Ayres et al, 1980) The low arctic air tem-

Table 3— Microbiological counts on selected reindeer forequarter surfaces.

<u>Surface</u>	<u>Log APC/in²</u>
Outer surface, left leg	2.95
Carcass, cut surface	2.70
Neck surface	2.78
Neck surface	2.47
Neck, cut surface	2.34
Shoulder surface	2.53
Diaphragm muscle, rib section	2.60
Exterior surface, rib	3.37
Interior surface, sternum	2.40
Exterior surface, sternum	3.00
Exterior surface, sternum	3.17
LD muscle, cut surface	3.39

peratures (usually around -23 degrees C) inhibited the growth of bacteria on the fresh meat. The relatively quick freezing of the carcasses further limited the growth of microorganisms by reducing water activity. Therefore, the field-harvesting techniques used yielded a product that was safe and wholesome.

Concluding Remarks

Two attributes important in the consumer's assessment of quality were studied. Although consumers may have questions about microbiological contamination of field-harvested reindeer, the forequarters studied were safe and wholesome. From a nutritional perspective, Alaskan reindeer should appeal to health-conscious consumers who wish to reduce their fat intake while consuming red meat. The forequarters evaluated were representative of animals harvested during the spring handling; different results may be found if animals slaughtered during handlings at other times of the year were studied.

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