



REINDEER RECIPES

gourmet meals featuring
Alaska's natural livestock

*Reindeer Research Program, University of Alaska Fairbanks
Kapi'olani Community College, University of Hawaii*

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PUBLICATION INFORMATION

A co-publication of the University of Alaska Reindeer Research Program,
UAF Northwest Campus, and Kap'iolani Community College

Printed in the United States of America by Alaska Printing, Inc.
Anchorage, Alaska

Editing and design by Deirdre Helfferich, University of Alaska Fairbanks
School of Natural Resources & Extension

Agricultural and Forestry Experiment Station
UAF Northwest Campus
Reindeer Research Program

AFES MP-2015-01

ISBN: 978-0-692-73865-8

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FOREWORD

When I first meet someone, the topic of

conversation inevitably turns to what I do for a living. I tell this person that I am a reindeer range ecologist. The person will cock their head with a look of amusement and confusion and I proceed to answer the question before they even ask. “A reindeer range ecologist studies the processes of converting vegetation into meat.” As soon as reindeer and meat are used in the same sentence this person will always make a strong proclamation in one of two ways: “I had some reindeer (stew, steak, roast, soup) and it was the best meat I have ever eaten” or they will say something to the effect of “I had reindeer (or caribou) meat once and never again; it was awful, tasted like liver.” How can one food item elicit such strong, but opposite, reactions from people?

Most of us have grown up cooking and consuming beef. As consumers and food preparers we are very familiar with beef and the countless grilling methods and recipes that complement the natural characteristics of beef. We go to the store with an expectation that the meat that we buy will cook up and taste like the meat we purchased yesterday.

I believe the reason there is such contradictory

palatability responses to consuming reindeer meat is first, we don't have consistency in quality and second, reindeer meat has very different physical and chemical characteristics than beef. A poor culinary experience with reindeer meat can be caused by harvesting the wrong animal (bull, steer, or female) during the wrong time of year (rut, winter, summer) or by harvesting animals in poor nutritional condition. The Reindeer Research Program, School of Natural Resources and Extension, University of Alaska Fairbanks has been conducting research to develop harvesting strategies and processing methods to ensure production of a uniform, consistently high quality reindeer meat product. For example, we now know meat from reindeer bulls harvested in July is of exceptional quality, with a very rich flavor and extremely tender, whereas a month later the quality characteristics of meat from these same animals have declined so dramatically in tenderness and flavor that the meat is practically inedible.

Reindeer meat has such unique characteristics that cooking it the same way as beef may lead to an unsatisfactory sensory experience. Much of the flavor

and tenderness of beef comes from inter-muscular fat, or "marbling." Reindeer deposit fat on the outside of their muscles so there is very little marbling of the meat. In turn, reindeer meat contains considerably less fat (see Reindeer Nutrition Facts, page 58) than beef, but as a result can easily become dried out if overcooked. Overcooking reindeer meat is a very common *faux pas*. Reindeer meat contains significantly more myoglobin (the red pigment that transfers oxygen from the bloodstream to muscle tissue) than beef (see Reindeer Nutrition Facts). Reindeer meat cooked to the same internal temperature as beef will look redder, and so it is perceived as rarer because of the higher concentration of red pigment. Many people will mistakenly continue to cook reindeer meat to a higher-than-recommended internal temperature (145°F for 15 seconds), which in conjunction with the lower fat content leads to the perception of eating a dry piece of meat.

For those looking to increase bio-available iron or trace minerals in their diets, reindeer meat contains high concentrations of these nutrients, particularly iron (see Nutrition Facts). The abundance of minerals also

gives reindeer meat a very rich flavor that complements soups, stews, and sausage but can also generate cooking challenges. Some cooking methods may promote the oxidation and accentuate the taste of iron, giving prepared reindeer meat a “livery” flavor.

Reindeer is naturally some of the most tender meat in the world (see Reindeer Nutrition Facts). The reindeer we raise in Alaska have been selectively bred to have a higher meat-to-bone ratio and very fine muscle fibers that promote tenderness. Reindeer muscle tissue also has higher concentrations of enzymes than other meats so enzymatic breakdown of muscle fibers after slaughter is very fast, and hence little aging (one to three days) is required for tenderization of meat.

Reindeer meat contains a higher concentration of protein (24%) than beef, is rich in vitamin A, vitamin E, and all the B vitamins, but low in cholesterol. Meat from free-range reindeer has more unsaturated fats than beef and contains 50–60% of unsaturated oleic acid which has been found to reduce LDL cholesterol (see Reindeer Nutrition Facts).

There are recipes found in Alaska cookbooks for preparing the traditional reindeer (caribou) stews,

soups, and steaks. We consider reindeer meat to be an exotic product, very different from beef and game meats, thus our intention of developing extraordinary recipes using a uniquely Alaska meat. Since Alaska is included in the Pacific Rim with many economic ties to a diversity of Pacific cultures, we wished to introduce reindeer meat to the Asian palate. To pioneer our way we enlisted the help of Ronald Takahashi and his team of experts at the Culinary Institute of the Pacific at the Kapi‘olani Community College, University of Hawaii. It was a challenge to develop recipes that would please the Asian palate and complement the nutritional and chemical characteristics of reindeer meat. Ron and his crew developed some amazing recipes, which any five-star restaurant would be proud to use. Please give them a try, but be forewarned — once you have prepared reindeer using one of these recipes no other meat will compare. Enjoy!

—Greg Finstad, director,
Reindeer Research Program

Chef Alan Tsuchiyama, Professor and Chef Instructor,
Kapi'olani Community College

Photos: Chef Adriana Torres Chong
Food Stylist and Photographer

Asian Braised Reindeer Stew with Eryngi Mushrooms and Wasabi Mashed Potato

Yield: 4 servings

The Stew:

1 ounce	Butter
1½ pounds	Reindeer shoulder, 1-inch cubes
2 ounces	Onions, large cut
1 ounce	Carrots, large cut
1 ounce	Celery, large cut
4 each	Star anise
4 each	Lemongrass, 3-inch stalk
1 each	Ginger, 2 inches, lightly crushed
16 ounces	Red wine
4 ounces	Soy sauce
3 ounces	Light brown sugar
16 ounces	Demi-glace or brown sauce

1. Sear reindeer in butter until brown.

2. Add onions, carrots, celery, star anise, lemongrass, and ginger.
3. Sauté for a minute and add red wine.
4. Simmer for a minute and add soy sauce, brown sugar, and demi-glace or brown sauce.
5. Cover and simmer until reindeer is tender. If sauce reduces too quickly, adjust by adding a little water.
6. Remove reindeer from sauce and reserve.
7. Strain sauce and return reindeer to sauce.

The Mushrooms:

1 ounce	Butter
6 ounces	Eryngi mushrooms, sliced
To taste	Salt
To taste	Pepper
1 tablespoon	Chives, hollow, sliced

1. Sauté mushrooms in butter until done.
2. Add chives.
3. Season with salt and pepper and serve.



Asian Braised Reindeer Stew with Eryngi Mushrooms and Wasabi Mashed Potato, continued:

The Potato:

1 pound	Yukon gold potatoes, peeled, cooked
2 ounces	Cream, heated
1 ounce	Butter
1 tablespoon	Wasabi paste
To taste	Salt
To taste	White pepper

1. While still hot, mash potatoes with cream, butter, and wasabi.
2. Season with salt and pepper and serve.

The Garnish:

4 each	Lemongrass stalk, 4 inches
As needed	Fried shoestring potatoes

Nutrition facts for Asian Braised Reindeer Stew with Eryngi Mushrooms and Wasabi Mashed Potato

Nutrition Facts

Serving Size 1 serving (708.8 g)

Amount Per Serving

Calories	900	Calories from Fat 303
Total Fat	33.7g	52%
Saturated Fat	15.9g	80%
Trans Fat	0.0g	
Cholesterol	242mg	81%
Sodium	2398mg	100%
Total Carbohydrates	68.7g	23%
Dietary Fiber	4.9g	20%
Sugars	26.0g	
Protein	60.2g	
Vitamin A 50%	•	Vitamin C 58%
Calcium 16%	•	Iron 88%

* Based on a 2000 calorie diet



Eryngi mushrooms, Pleurotus eryngii.

Chipotle Tomato Penne Pasta with Reindeer, Arugula, Shimeji Mushrooms, Tomato, and Parmesan Cheese

Yield: 4 servings

The Sauce:

4 ounces	Olive oil
4 ounces	Onions, small dice
1 ounce	Garlic, chopped
1 pound	Tomatoes, seeded, chopped
¾ ounce	Chipotle, chopped
To taste	Salt
To taste	Pepper

1. On medium heat sauté onions and garlic in oil until translucent.
2. Add tomatoes and chipotle and simmer until tomatoes and juices reduce and sauce thickens.
3. Season with salt and pepper.

The Pasta:

1 ounce	Butter
8 ounces	Reindeer, sliced, bite-size
4 ounces	Shimeji mushrooms
20 each	Grape, cherry, or teardrop tomatoes, cut in half
2 ounces	Arugula
24 ounces	Penne pasta, cooked
1 tablespoon	Parsley, chopped
To taste	Salt
To taste	Pepper
As needed	Parmesan cheese, shaved

1. Heat butter and sauté reindeer until half done.
2. Add shimeji mushrooms and cook for a minute.
3. Add grape tomatoes, chipotle tomato sauce, arugula, parsley, salt, and pepper.
4. Add Parmesan cheese, toss, and serve.



Chipotle Tomato Penne Pasta with Reindeer, Arugula, Shimeji Mushrooms, Tomato, and Parmesan Cheese,
continued:

The Parmesan Crisp:

2 ounces Parmesan cheese, shredded

1. Spread a thin layer of cheese on a Silpat® or parchment paper.
2. Place in a 350°F oven until golden brown.
3. While still hot and soft, cut into desired shape.
4. Cool until crisp.

The Garnish:

4 each	Parmesan crisp
12 leaves	Arugula, fried

Nutrition facts for Chipotle Tomato Penne Pasta with Reindeer, Arugula, Shimeji Mushrooms, Tomato, and Parmesan Cheese

Nutrition Facts

Serving Size 1 serving (1431.6 g)

Amount Per Serving

Calories	1237	Calories from Fat 471
Total Fat	52.3g	% Daily Value*
Saturated Fat	17.1g	80%
Trans Fat	0.0g	86%
Cholesterol	242mg	81%
Sodium	786mg	33%
Total Carbohydrates	133.1g	44%
Dietary Fiber	10.0g	40%
Sugars	21.1g	
Protein	66.0g	
Vitamin A 69%	•	Vitamin C 297%
Calcium 71%	•	Iron 130%

* Based on a 2000 calorie diet

Dried chipotle chiles tipico. Photo by Badagnani (Wikimedia Commons), CC BY 3.0 license



Grilled Cabernet-Marinated Reindeer with Garlic Chive Butter, Charred Radicchio, and Baby Greens with Sherry Vinaigrette

Yield: 4 servings

The Reindeer:

4 each	4-ounce reindeer tenderloin
4 leaves	Sage, chopped
1 sprig	Rosemary, chopped
6 leaves	Mint, chopped
1 sprig	Thyme, chopped
1 tablespoon	Garlic, chopped
¼ ounce	Shallots, chopped
2 ounces	Red wine
1 ounce	Olive oil
To taste	Salt
To taste	Pepper

1. Mix the sage, rosemary, mint, thyme, garlic, shallots, red wine, and olive oil together to create a marinade.
2. Marinate the reindeer overnight.
3. Season with salt and pepper.
4. Grill to desired doneness.
5. Rest reindeer for five minutes and slice.

The Butter:

4 ounces	Butter, softened
½ ounce	Garlic chives, finely chopped
¼ ounce	Lemon juice
1 tablespoon	Shallots, chopped
1 tablespoon	Garlic, chopped
½ teaspoon	Worcestershire sauce
½ teaspoon	Dijon mustard
To taste	Salt
To taste	Pepper

1. Mix all ingredients together.
2. In a pan heat butter until very soft but not melted and drizzle over reindeer.



Grilled Cabernet-Marinated Reindeer with Garlic Chive Butter, Charred Radicchio, and Baby Greens with Sherry Vinaigrette, continued:

The Vinaigrette:

½ ounce	Sherry vinegar
½ ounce	Shallots, chopped
1 teaspoon	Garlic, chopped
1 ounce	Extra virgin olive oil
To taste	Salt
To taste	Pepper
1 teaspoon	Dijon mustard

1. Mix all ingredients together.

The Radicchio:

1 head	Radicchio, wedged
As needed	Extra virgin olive oil
To taste	Salt

To taste	Pepper
As needed	Sherry vinaigrette

1. Mix radicchio, olive oil, salt and pepper.
2. Grill until wilted.
3. Gently mix well with vinaigrette.

The Greens:

1 ounce	Baby greens
As needed	Sherry vinaigrette
To taste	Salt
To taste	Pepper

1. Gently mix baby greens with vinaigrette and season with salt and pepper.

The Garnish:

4 each	Nasturtium flowers
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Rialto market radicchio.
Photo by Marieke Kuijjer
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Nutrition facts for Grilled Cabernet-Marinated Reindeer with Garlic Chive Butter, Charred Radicchio, and Baby Greens with Sherry Vinaigrette

Nutrition Facts

Serving Size 1 serving (229.8 g)

Amount Per Serving

Calories	548	Calories from Fat	383
Total Fat	42.6g	% Daily Value*	66%
Saturated Fat	18.6g		93%
Trans Fat	0.0g		
Cholesterol	185mg		62%
Sodium	269mg		11%
Total Carbohydrates	4.5g		1%
Dietary Fiber	0.6g		2%
Sugars	0.5g		
Protein	35.1g		

Vitamin A 22% • Vitamin C 16%
Calcium 5% • Iron 42%
* Based on a 2000 calorie diet





Pan-Fried Corn and Thyme-Crusted Reindeer with Cream of Corn and Tomato, Sautéed Spinach and Mushrooms with a Balsamic Vinaigrette and Herb Oil

Yield: 4 servings

The Reindeer:

8 each	2-ounce reindeer cutlet
To taste	Salt
To taste	Pepper
1 cup	Corn meal
1½ teaspoons	Thyme, chopped
As needed	Flour for breading
As needed	Eggs, beaten for breading
As needed	Oil for pan frying

1. Season reindeer with salt and pepper.
2. Mix corn meal and thyme together and reserve.
3. Lightly dust reindeer in flour.

4. Dip dusted reindeer in eggs.
5. Dredge egg-dipped reindeer in reserved corn meal.
6. Heat oil and pan-fry reindeer until golden brown.

The Mushrooms with Balsamic Vinaigrette:

1 ounce	Balsamic vinegar
¼ tablespoon	Shallots, chopped
½ teaspoon	Garlic, chopped
½ teaspoon	Dijon mustard
1 ounce	Extra virgin olive oil
To taste	Salt
To taste	Pepper
1 ounce	Butter
8 ounces	Assorted mushrooms
2 tablespoons	Chives, hollow, sliced

1. Mix together balsamic vinegar, shallots, garlic, Dijon mustard, extra virgin olive oil, salt, and pepper, and reserve.

Pan-Fried Corn and Thyme-Crusted Reindeer with Cream of Corn and Tomato, Sautéed Spinach and Mushrooms with a Balsamic Vinaigrette and Herb Oil, continued:

2. Heat butter and sauté assorted mushrooms until done.
3. Add chives and reserved balsamic vinaigrette.

The Cream of Corn:

½ ounce	Butter
1 ounce	Onions, small dice
4 ounces	Fresh corn kernels
4 ounces	Cream
8 each	Grape, cherry, or teardrop tomatoes, cut in half
To taste	Salt
To taste	Pepper

1. Heat butter and sauté onions until translucent.

2. Add corn and cream. Simmer until cream is slightly thick.
3. Add tomatoes and season with salt and pepper.

The Spinach:

½ ounce	Butter
¼ ounce	Shallots, chopped
8 ounces	Spinach leaves
To taste	Salt
To taste	Pepper

1. Heat butter and sauté shallots.
2. Add spinach and sauté until wilted.
3. Season with salt and pepper.

Nutrition facts for Pan-Fried Corn and Thyme-Crusted Reindeer with Cream of Corn and Tomato, Sautéed Spinach and Mushrooms with a Balsamic Vinaigrette and Herb Oil

Nutrition Facts

Serving Size 1 serving (622.5 g)

Amount Per Serving

Calories	694	Calories from Fat	324
Total Fat	36.0g	% Daily Value*	55%
Saturated Fat	15.0g		75%
Trans Fat	0.0g		
Cholesterol	217mg		72%
Sodium	344mg		14%
Total Carbohydrates	52.7g		18%
Dietary Fiber	8.9g		36%
Sugars	11.2g		
Protein	46.0g		
Vitamin A	126%	•	Vitamin C 128%
Calcium	13%	•	Iron 94%

* Based on a 2000 calorie diet

Spinach. Photo by Schwäbin (Wikimedia Commons), CC BY-SA 3.0-de (Germany) license



Pan-Seared Reindeer with Port Wine Pan Sauce, Caramelized Apples, and Wilted Arugula

Yield: 4 servings

The Reindeer:

4 each	4-ounce reindeer tenderloin
2 ounces	Port wine
4 leaves	Sage, chopped
1 sprig	Rosemary, chopped
6 leaves	Mint, chopped
2 sprigs	Thyme, chopped
1 teaspoon	Garlic, chopped
¼ ounce	Shallots, chopped
To taste	Salt
To taste	Pepper
½ ounce	Butter

1. Combine port wine, sage, rosemary, mint, thyme, and garlic. Place reindeer tenderloin into marinade. Marinate for 2 hours or overnight.
2. Remove from marinade and pat dry. Season with salt and pepper.
3. Heat butter and pan sear until medium rare. Remove from pan and let sit for five minutes.

The Sauce:

½ ounce	Butter
2 ounces	Onion, small dice
1 ounce	Carrots, small dice
1 ounce	Celery, small dice
4 ounces	Port wine
4 ounces	Demi-glace or brown sauce
To taste	Salt
To taste	Pepper

1. In the pan add the onions, carrots, and celery. Sauté until light brown.



Pan-Seared Reindeer with Port Wine Pan Sauce,
Caramelized Apples, and Wilted Arugula, continued:

2. Remove pan from heat and add port wine. Return to heat and simmer for a minute.
3. Add demi-glace or brown sauce.
4. Simmer and strain.
5. Season with salt and pepper.

The Apples:

½ ounce	Butter
1 each	Apple, $\frac{3}{8}$ -inch dice
1 pinch	Cinnamon, ground
To taste	Salt

1. Heat butter and sauté apples until caramelized and cooked but not soft.
2. Add cinnamon and salt.

The Arugula

½ ounce	Butter
2 ounces	Arugula
To taste	Salt
To taste	Pepper

1. Heat butter and add arugula.
2. Season with salt and pepper and cook until wilted.

The Garnish

4 each	Apple, sliced in cross section, very thin
2 ounces	Simple syrup

1. Dip apple into simple syrup and place between two Silpats®.
2. Bake in a 300°F oven until light brown and the moisture from the apples is removed.
3. Cool and carefully remove from Silpat®.

Arugula blossom.

Photo by Joaquim Alves Gaspar (Wikimedia Commons), CC BY-SA 3.0 license



Nutrition facts for Pan-Seared Reindeer with Port Wine Pan Sauce, Caramelized Apples, and Wilted Arugula

Nutrition Facts

Serving Size 1 serving (622.5 g)

Amount Per Serving

Calories 694 Calories from Fat 324

% Daily Value*

Total Fat 36.0g 55%

 Saturated Fat 15.0g 75%

 Trans Fat 0.0g

Cholesterol 217mg 72%

Sodium 344mg 14%

Total Carbohydrates 52.7g 18%

 Dietary Fiber 8.9g 36%

 Sugars 11.2g

Protein 46.0g

Vitamin A 126% • Vitamin C 128%

Calcium 13% • Iron 94%

* Based on a 2000 calorie diet

Reindeer Curry with Kabocha, Sweet Potato, Fried Shallots, and Pine Nuts

Yield: 4 servings

The Curry:

1 pound	Reindeer, sliced, bite size
To taste	Salt
To taste	Pepper
1 ounce	Butter
1 ounce	Red Thai curry paste, amount may vary depending on the brand of curry paste and the degree of spiciness
12 ounces	Coconut milk
4 each	Lemongrass stalk, 3 inches, lightly crushed
4 each	Kaffir lime leaves, crushed with hand

12 each	Kabocha pumpkin, boiled or steamed, bite size
40 each	Thai basil leaves

1. Season reindeer with salt and pepper.
2. Sauté reindeer in butter until half done and reserve.
3. Add curry paste to pan and sauté until fragrant.
4. Add coconut milk, lemongrass, kaffir lime leaves.
5. Simmer until reduced and slightly thick.
6. Add kabocha, reserved reindeer, and basil leaves.
7. Simmer for a few minutes.

The Garnish:

12 each	Boiled purple sweet potato, bite size
1 ounce	Coconut cream, to drizzle
1 ounce	Pine nuts, toasted
As needed	Fried shallots
4 sprigs	Thai basil



Nutrition facts for Reindeer Curry with Kabocha, Sweet Potato, Fried Shallots, and Pine Nuts

Nutrition Facts

Serving Size 1 serving (1581.9 g)

Amount Per Serving

Calories	796	Calories from Fat	380
		% Daily Value*	
Total Fat	42.2g	65%	
Saturated Fat	25.8g	129%	
Trans Fat	0.0g		
Cholesterol	139mg	46%	
Sodium	279mg	12%	
Total Carbohydrates	67.1g	22%	
Dietary Fiber	17.3g	69%	
Sugars	27.4g		
Protein	52.5g		
Vitamin A 55%	:	Vitamin C 371%	
Calcium 22%	:	Iron 81%	

* Based on a 2000 calorie diet

Kaffir lime leaves. Public domain image (see Wikimedia)





Thai basil in flower. Photo by les. Creative Commons
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Roasted Maple Dijon-Glazed Tenderloin of Reindeer with Oven-Roasted Beets and Sautéed Brussels Sprout Leaves with Bacon

Yield: 4 servings

The Reindeer:

4 each	4-ounce reindeer tenderloin
To taste	Salt
To taste	Pepper
½ ounce	Oil
2 ounces	Maple syrup
2 ounces	Dijon mustard

1. Season reindeer with salt and pepper.
2. Sear reindeer until brown.
3. Mix maple syrup and Dijon mustard together and spread over seared reindeer.

4. Roast in 300°F oven until 130°F internal temperature has been reached.
5. Remove from oven and let rest for five minutes before slicing. Reserve pan for sauce.

The Sauce:

2 ounces	Brown stock
6 ounces	Demi-glace or brown sauce
To taste	Salt
To taste	Pepper

1. Remove excess fat from reserved pan.
2. Deglaze pan with brown stock.
3. Add demi-glace of brown sauce.
4. Season with salt and pepper.
5. Strain sauce.



Roasted Maple Dijon-Glazed Tenderloin of Reindeer with Oven-Roasted Beets and Sautéed Brussels Sprout Leaves with Bacon, continued:

The Beets:

1 each	Beets, peeled, sliced $\frac{1}{4}$ inch thick
1 pinch	Cardamom, ground
1 pinch	Cloves, ground
1 pinch	Cinnamon, ground
To taste	Salt
To taste	Pepper
1 ounce	Oil

1. Mix all ingredients together.
2. Place in foil and wrap up air tight.
3. Place in a 350°F oven and roast until beets are tender.

The Brussels sprouts:

2 ounces	Bacon, sliced thin
1 ounce	Onions, chopped
1 teaspoon	Garlic, chopped
4 ounces	Brussels sprout leaves
1 pinch	Nutmeg, ground
To taste	Salt
To taste	Pepper

1. Render fat from bacon.
2. Add onions and garlic and cook until translucent.
3. Add Brussels sprouts and sauté until wilted.
4. Season with nutmeg, salt, and pepper.

**Nutrition facts for Roasted Maple Dijon-Glazed
Tenderloin of Reindeer with Oven-Roasted Beets
and Sautéed Brussels Sprout Leaves with Bacon**

Nutrition Facts

Serving Size 1 serving (284.6 g)

Amount Per Serving

Calories	461	Calories from Fat	214
		% Daily Value*	37%
Total Fat	23.8g		37%
Saturated Fat	5.3g		26%
Trans Fat	0.0g		
Cholesterol	139mg		46%
Sodium	808mg		34%
Total Carbohydrates	18.8g		6%
Dietary Fiber	2.3g		9%
Sugars	11.5g		
Protein	42.1g		
Vitamin A 9%	•	Vitamin C 51%	
Calcium 8%	•	Iron 47%	

* Based on a **2000 calorie diet**

Green and black cardamom.

Photo by Autopilot (Wikimedia Commons), CC BY-SA 3.0



Roasted Rosemary Dijon Reindeer Sandwich with Baby Greens and Balsamic Vinaigrette, Tomato and Kalamata Compote, Roasted Garlic Aioli, and Shaved Sweet Onions

Yield: 4 servings

The Reindeer:

1 pound	Reindeer, round
1½ tablespoons	Rosemary, chopped
To taste	Salt
To taste	Pepper
1 ounce	Butter
2 ounces	Dijon mustard

1. Season reindeer with rosemary, salt, and pepper.
2. Heat butter and sear reindeer until brown.
3. Cover reindeer with Dijon mustard.
4. Roast in a 350°F oven.

5. Remove from oven when an internal temperature of 130°F has been reached.
6. Chill and slice thin.

The Compote:

2 ounces	Olive oil
1 tablespoon	Fennel seeds
2 ounces	Onions, small dice
1 tablespoon	Garlic, chopped
1 pound	Tomatoes, seeded, chopped
½ ounce	Tomato paste
2 ounces	Kalamata olives, chopped
To taste	Salt
To taste	Pepper

1. On medium heat, sauté fennel seeds, onions, and garlic in olive oil. Cook until onions are translucent.
2. Add tomatoes and tomato paste. Cook until tomatoes and compote's juices are reduced and thickened.



Roasted Rosemary Dijon Reindeer Sandwich with Baby Greens and Balsamic Vinaigrette, Tomato and Kalamata Compote, Roasted Garlic Aioli, and Shaved Sweet Onions, continued:

3. Add Kalamata olives and season with salt and pepper.
4. Cool, use as a spread.

The Aioli:

1 ounce	Olive oil
4 ounces	Garlic
4 ounces	Mayonnaise
To taste	Salt
To taste	Pepper

1. Heat olive oil and sauté garlic until fragrant. Do not brown. Cool.
2. Add garlic to mayonnaise and season with salt and pepper. Use as a spread.

The Balsamic Vinaigrette:

1 ounce	Balsamic vinegar
1 tablespoon	Shallots, brunoise
½ teaspoon	Garlic, chopped
1 teaspoon	Dijon mustard
1 ounce	Extra virgin olive oil
To taste	Salt
To taste	Pepper

1. Mix all ingredients together.

The Greens:

2 ounces	Baby greens
As needed	Balsamic vinaigrette
To taste	Salt
To taste	Pepper

1. Gently toss baby greens with balsamic vinaigrette and season with salt and pepper.

The Bread:

4 servings

Favorite bread, sliced for sandwich

The Garnishes:

- As needed Parmesan cheese, shaved
- As needed Sweet onions, thinly sliced

Softneck garlic heads. Photo by Donovan Govan, CC BY-SA 3.0 license



Nutrition facts for Roasted Rosemary Dijon Reindeer Sandwich with Baby Greens and Balsamic Vinaigrette, Tomato and Kalamata Compote, Roasted Garlic Aioli, and Shaved Sweet Onions

Nutrition Facts

Serving Size 1 serving (413.1 g)

Amount Per Serving

Calories	829	Calories from Fat	563	
Total Fat	62.5g	% Daily Value*	96%	
Saturated Fat	13.1g		66%	
Trans Fat	0.0g			
Cholesterol	150mg		50%	
Sodium	715mg		30%	
Total Carbohydrates	30.2g		10%	
Dietary Fiber	5.3g		21%	
Sugars	5.2g			
Protein	39.9g			
Vitamin A	12%	•	Vitamin C	69%
Calcium	17%	•	Iron	64%

* Based on a 2000 calorie diet

Spiced Reindeer with Peach and Cranberry Compote, Fennel Arugula Salad Tossed in a Citrus Honey Vinaigrette

Yield: 4 servings

The Reindeer

4 each	4-ounce reindeer tenderloin
2 teaspoons	Cumin, whole, toasted, ground
2 teaspoons	Coriander seed, whole, toasted, ground
1 teaspoon	Fennel seed, whole, toasted, ground
2 teaspoons	Thyme, dried
2 teaspoons	Oregano, dried
1/4 teaspoon	Cayenne pepper
1/4 teaspoon	Black pepper
To taste	Salt
1 ounce	Butter

1. Mix all the spices and salt together.
2. Season reindeer with spice mix.
3. Brown reindeer in butter and cook until it reaches 130°F internal temperature. Remove from heat.
4. Rest for a few minutes and slice.

The Peach:

1 ounce	Dried cranberries
2 ounces	Cranberry juice
1 ounce	Butter
2 each	Peach, wedges
Pinch	Cinnamon, ground
To taste	Salt

1. Soak cranberries in cranberry juice for one hour.
2. Remove cranberries and reserve.
3. Heat butter and add peaches, reserved cranberries, and cinnamon.
4. Season with salt.



Spiced Reindeer with Peach and Cranberry Compote,
 Fennel Arugula Salad Tossed in a Citrus Honey Vinaigrette,
 continued:

The Vinaigrette:

1 teaspoon	Orange zest, chopped	1 ounce	Arugula
1 teaspoon	Lemon zest, chopped	As needed	Citrus honey vinaigrette
1 ounce	Orange juice	To taste	Salt
½ ounce	Lemon juice	To taste	Pepper
1 ounce	Salad oil		
½ ounce	Honey		
To taste	Salt		
To taste	Pepper		

1. Mix all ingredients together.

The Salad:

4 ounces	Fennel, sliced thin, soaked in ice water
12 each	Orange segments

1. Gently mix fennel, orange, and arugula with the vinaigrette.
2. Season with salt and pepper.

The Garnish:

4 sprig	Fennel frond
4 each	Nasturtium flowers

Nasturtium flowers. Photo by Nancy Tarnai



Nutrition facts for Spiced Reindeer with Peach and Cranberry Compote, Fennel Arugula Salad Tossed in a Citrus Honey Vinaigrette

Nutrition Facts

Serving Size 1 serving (305.4 g)

Amount Per Serving

Calories	441	Calories from Fat	220
		% Daily Value*	
Total Fat	24.4g	38%	
Saturated Fat	10.4g	52%	
Trans Fat	0.0g		
Cholesterol	154mg	51%	
Sodium	170mg	7%	
Total Carbohydrates	20.7g	7%	
Dietary Fiber	4.8g	19%	
Sugars	13.1g		
Protein	35.9g		
Vitamin A 20%	•	Vitamin C 76%	
Calcium 12%	•	Iron 52%	

* Based on a 2000 calorie diet

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LOSSARY

Brown sauce: In classical French cuisine, a brown sauce generally refers to a sauce with a meat stock base, thickened by reduction and sometimes the addition of a browned roux, similar in some ways to, but more involved than, a gravy. Brown sauce is also known as espagnole sauce, one of the five mother sauces of classical French cuisine.

Brunoise: A culinary knife cut in which the food item is first julienned and then turned a quarter turn and diced again, producing cubes of about 3 mm or less on each side. In France a “brunoise” cut is smaller, 1 to 2 mm on each side. Common items to be brunoised are leeks, turnips, and carrots. The diced vegetables are blanched briefly in salty, boiling water and then submerged in salted ice water for a few seconds to set the color. The brunoise is used as a garnish in many dishes. A brunoise should be consistent in size and shape, as this helps to create a pleasing presentation.

Button mushrooms: *Agaricus bisporus* is cultivated in more than 70 countries and is one of the most commonly and widely consumed mushrooms in the world. When white, it is variously known

as the common, button, white, cultivated, table, champignon, or cremini mushroom; when brown (having been exposed to sunlight), as the Swiss brown, Roman brown, Italian brown, Italian, brown cap, or chestnut mushroom; and when mature as the Portobello mushroom. It is native to grasslands in Europe and North America. It is closely related to the field, or meadow, mushroom, *Agaricus campestris*.

Chipotle: A smoke-dried jalapeño chile used primarily in Mexican and Mexican-inspired cuisines, such as Mexican-American and Tex-Mex. Mature chiles that have been left on the bush as long as possible are picked when they are deep red or purple and have lost much of their moisture. They are then smoked slowly over several days. They impart a relatively mild but earthy spiciness and a distinctive smoky flavor. Varieties of chile commonly used for chipotles include morita, meco, ahumado, and típico chiles.

Coconut cream and coconut milk: **Coconut milk** is the liquid that comes from the grated meat of a coconut. The color and rich taste of the milk can be attributed to the high oil content. Most of the fat is saturated fat. Coconut milk is a very popular

food ingredient used in Southeast Asia, especially in Thailand, Malaysia, Indonesia, Singapore, and the Philippines. Several grades of coconut milk exist: from thick at 20-22 percent fat to thin at 5-7 percent fat. Thick milk is mainly used to make desserts as well as rich and dry sauces. Thin milk is used for soups and general cooking. (**Coconut water** is the clear watery liquid that comes from the young, still immature green coconut. Coconut water is a popular fresh drink in Southeast Asia.)

Coconut cream is very similar to coconut milk but contains less water. The difference is mainly consistency. It has a thicker, more paste-like consistency, while coconut milk is generally a liquid. Coconut cream has a mild non-sweet taste.

Thick coconut milk can be made by directly squeezing grated coconut meat through cheesecloth. The squeezed coconut meat is then soaked in warm water and squeezed a second or third time for **thin** coconut milk. Some recipes call for shredding chopped fresh coconut in a blender with coconut water, and then straining through cheesecloth. Coconut cream can be made by simmering 1 part

shredded coconut with one part water or milk until frothy, then straining the mixture through a cheesecloth, squeezing out as much liquid as possible; this is coconut milk. The coconut milk is refrigerated and allowed to set. Coconut cream is the thick non-liquid part that separates and rises to the top of the coconut milk.

Demi-glace: A rich brown sauce in French cuisine used by itself or as a base for other sauces. The term comes from the French word *glace*, which when used in reference to a sauce means icing or glaze. It is traditionally made by combining equal parts of veal stock and sauce espagnole, simmering the mixture, and reducing it by half. Common variants of demi-glace use a 1:1 mixture of beef or chicken stock to sauce espagnole; these are referred to as “beef demi-glace” (*demi-glace au boeuf*) or “chicken demi-glace” (*demi-glace au poulet*). The term “demi-glace” by itself implies that it is made with the traditional veal stock.

The basic recipe for demi-glace is provided by the French chef Auguste Escoffier, who is often considered to have established the method of

French cooking as well as codified many of the standard French recipes. Although many recipes for demi-glace give the preparation for the espagnole first, and then the recipe for the brown stock, preparation should actually proceed in the reverse. A basic brown stock should be prepared and, when completed, left on the heat to remain very warm. At this point the espagnole is prepared, and when it is finished, the brown stock is added in equal portions to the espagnole. Demi-glace keeps very well, about six months refrigerated or almost indefinitely frozen.

Eryngi mushroom: *Pleurotus eryngii* (also known as king trumpet, French horn, or king oyster mushroom) is an edible mushroom native to Mediterranean regions of Europe, the Middle East, and North Africa, but also grown in parts of Asia. In Chinese, it is called *xìng bào gū* (lit. “almond abalone mushroom”), *cì qín gū* (lit. “stab celery mushroom”), or *cì qín cè ēr* (lit. “stab celery side ear”). In Japanese, it is called *eringi*. (See photos p. 9 and 11.)

It is the largest species in the oyster mushroom genus. It has a thick, meaty, white stem and a small, tan cap (in young specimens). It has little flavor or

aroma when raw. When cooked, it develops typical mushroom umami flavors with a texture similar to that of abalone.

The mushroom has a good shelf life. An effective cultivation method was introduced to Japan around 1993; the eryngi has become popular there and is used in a variety of dishes, and it is now cultivated and sold commercially in Australia.

Extra virgin olive oil: The highest grade of edible olive oil according to the International Olive Oil Council's standards, which are: extra virgin, virgin, pure, olive oil, pomace olive oil, lampante oil (not suitable for food), and refined olive oil. These grades relate to the amount of free acid in the oil, which causes rancidity. USDA grades are: US Grade A or US Fancy; US Grade B or Choice; US Grade C or Standard; and US Grade D or Substandard.

Quantitative analysis can determine the oil's acidity, defined as the percent, measured by weight, of the free oleic acid it contains. This is a measure of the oil's chemical degradation; as the oil degrades, more fatty acids are freed from the glycerides, increasing the level of free acidity and thereby increasing

rancidity. Another measure of the oil's chemical degradation is the organic peroxide level, which measures the degree to which the oil is oxidized, another cause of rancidity.

Kabocha: A Japanese variety of winter squash, with hard, knobbly-looking skin, shaped like a squatty pumpkin and having a dull, deep-green skin with some celadon-to-white stripes and an intense yellow-orange color on the inside. In many respects it is similar to the buttercup squash but without the characteristic cup on the blossom end. It is a member of the species *Cucurbita maxima*. An average kabocha weighs 2-3 pounds but can weigh as much as 8 pounds. It has an exceptional naturally sweet flavor, even sweeter than butternut squash. It is similar in texture and flavor to a pumpkin and a sweet potato combined.

Kaffir lime: Also known as *limau purut* or makrut lime, the kaffir lime (*Citrus hystrix*) is native to Laos, Indonesia, Malaysia, and Thailand. It is used in Southeast Asian cuisine but grown worldwide as a backyard shrub. It bears a rough, warty green fruit that grows on a thorny bush with aromatic and

distinctively shaped “double” leaves (see photo p. 30). It is well-suited to container growing. The green fruit is distinguished by its bumpy exterior and its small size (approximately 4 cm wide).

Kalamata olives: Named after the southern Greek city of Kalamata where they are grown, these almond-shaped olives are a deep-purple/red or black with a fruity flavor and smooth, meaty texture. The tree is distinguished from the common olive by the size of its leaves, which grow to twice the size of other olive varieties. Kalamata olives cannot be harvested green and must be hand-picked in order to avoid bruising. Olive oil produced from the Kalamata olive has a faintly grassy flavor. Kalamata olives are protected under the European Protected Geographical Status scheme.

Lemongrass: A genus of about 55 tall perennial grasses, *Cymbopogon* species are native to warm temperate and tropical regions of the Old World and Oceania. The type species lemongrass is *Cymbopogon citratus*, native to India and tropical Asia. It is widely used as an herb in Asian cuisine. It has a subtle citrus flavor and can be dried and powdered or

used fresh. Lemongrass is commonly used in teas, soups, and curries. It is also suitable for poultry, fish, beef, and seafood. It is often used as a tea in African countries such as Togo and the Democratic Republic of the Congo and Latin American countries such as Mexico.

East Indian lemongrass (*C. flexuosus*), also called Cochin grass or Malabar grass, is native to Cambodia, Vietnam, India, Sri Lanka, Burma, and Thailand, while West Indian lemongrass (*C. citratus*) is native to maritime Southeast Asia. It is known as *serai* in Malaysia, *serai* or *sereh* in Indonesia, and *tanglad* in the Philippines. While both can be used interchangeably, *C. citratus* is more suited for cooking.

Use lemongrass stalks that are fragrant, tightly formed, and of a lemony-green color near the bulb, turning to a truer green at the end of the stalk. Avoid stalks that are loose and coming apart or that are brown, crusted, or crumbling.

Parchment paper: A heavy-duty grease- and moisture-resistant paper that is used in baking and cooking to provide a heat-resistant, nonstick surface. Parchment paper is made from paper that is treated

with sulfuric acid to give it high stability and high heat resistance. The process partially dissolves or gelatinizes the paper and forms a sulfurized cross-linked material with high density, stability, and heat resistance, and low surface energy—thereby imparting good non-stick or release properties. The treated paper has an appearance similar to that of traditional parchment, hence the name. The treated paper may also be coated with a nonstick material, typically silicone, to give it its nonstick properties. Parchment paper is safe to use to temperatures up to 420-450°F and is best used in a regular or convection oven, not under a broiler.

Pine nuts: The edible seeds of pines (family Pinaceae, genus *Pinus*). About 20 species of pine produce seeds large enough to be worth harvesting; others are edible but too small for commercial harvest. Commercially available pine nuts include pinyon pines (North America), the stone pine (Europe), the Korean pine (northeast Asia), and others.

Radicchio: A leaf chicory (*Cichorium intybus*) sometimes known as Italian chicory, and a perennial. It is grown as a leaf vegetable that usually has white-

veined red leaves. It has a bitter and spicy taste, which mellows when it is grilled or roasted.

Humans have used radicchio since ancient times. Pliny the Elder wrote of it in *Naturalis Historia*, praising its medicinal properties as an aid for insomniacs. The plant contains intybin, a sedative/analgesic, and the purple-red pigments, anthocyanin flavonoids, which are powerful antioxidants.

Modern cultivation of the plant began in the fifteenth century, in the Veneto and Trentino regions of Italy, but the radicchio of today was engineered in 1860 by the Belgian agronomist Francesco Van den Borre, who applied a technique used on endive called *imbianchimento* (whitening), preforcing or blanching, to create the dark red, white-veined leaves. Growing normally, radicchio plants are green. In preforcing, the radicchio are taken from the ground in late fall, their outer leaves removed, and the heads placed in 60°F water in darkened sheds for several days, where lack of light and ensuing inhibition of chlorophyll production cause the plants to lose their green pigmentation. The deeper the red the more bitter the plant becomes. (See photo p. 19.)

Reindeer: (See also About Reindeer, p. 53) Reindeer meat is a high-quality product that is attractive to the health-conscious consumer for its low fat content (around 2 percent, comparable to chicken), favorable proportions of healthy fats, and high mineral content. It is very high in B-12 (more than twice veal or lamb), omega-3, omega-6, and other essential fatty acids, and it contains high amounts of selenium, zinc, and iron. Consumers are often attracted to its exotic quality, and its production, wherein the animals graze during most of the year, is usually considered more animal-friendly and ethical compared with the standard commercial production methods for beef, pork, or chicken.

Shimeji mushrooms: Shimeji are a group of edible mushrooms native to East Asia that includes more than 20 varieties; a popular and widely cultivated species is buna-shimeji (beech mushroom, *Hypsizygus tessellatus*). Shimeji should be eaten cooked, as they have a bitter taste when raw that disappears completely upon cooking. The cooked mushroom has a firm, slightly crunchy texture, and a nutty flavor. Cooking also makes the mushroom easier to digest.

Silpat®: Trademarked nonstick silicone baking mat made by Sasa Demarle, Inc., and invented by the company founder, baker Monsieur Guy Demarle of France.

Simple syrup: Sugar and water boiled together to create a syrup. Different densities of simple syrup have different uses. The thickness depends on the ratio of water to sugar used.

Thin Simple Syrup: Three parts water to one part sugar, commonly used to glaze cakes and cookies.

Medium Simple Syrup: Two parts water to one part sugar, used to sweeten sorbets and beverages.

Thick or Rich Simple Syrup (basic simple syrup): One part water to one part sugar, used for cold fruit drinks, cocktails, candied fruits.

To make simple syrup, bring cold water and sugar to a boil in a high-sided saucepan over medium-high heat. Turn the heat to low and stir constantly until the sugar dissolves completely and the mixture is clear, approximately 3 to 5 minutes. The longer it is boiled, the thicker the syrup will be when cooled. To test if the sugar is completely dissolved, take out

a small amount of the syrup with a spoon. No sugar crystals should be visible in the liquid. If they are, boil a little longer.

Star anise: A spice that closely resembles anise in flavor, star anise is obtained from the star-shaped fruit of *Illicium verum*, a medium-sized native evergreen tree of northeast Vietnam and southwest China. The fruits are harvested just before ripening. The dark brown pod is about 1 inch across and contains one seed in each of its eight segments. Its flavor is slightly more bitter than that of regular anise seed. Asian cooks use star anise to give a licorice flavor to savory dishes, particularly those with pork and poultry. Whole star anise is used to flavor tea, marinades, and soups. It is integral to the traditional Vietnamese soup *phō* and is used in many other Chinese and Southeast Asian dishes. Ground star anise, besides being used in baked goods, is a main ingredient in Chinese five-spice powder.

Sweet potato: *Ipomoea batatas*, known as sweet potato, *batata*, *kumar* or *kumara*, desert truffle, and yam (this last is a misnomer, as yams are in a different family), is a versatile plant used for

everything from desserts to soups, noodles, bread, chips, main courses, and more. It is baked, stewed, boiled, fried, steamed, and fermented. The young leaves and shoots are sometimes eaten as greens. The tuber is long and tapered, with a smooth skin whose color ranges between yellow, orange, red, brown, purple, and beige. Its flesh ranges from beige through white, red, pink, violet, yellow, orange, and purple. Sweet potato varieties with white or pale yellow flesh are less sweet and moist than those with purple, red, pink, or orange flesh. Purple-fleshed sweet potatoes (see photo p. 29) are particularly high in anthocyanin pigments, strong antioxidants. Sweet potatoes are native to Central America and are one of the oldest vegetables known to humanity.

Wasabi: A member of the Brassicaceae family, *Wasabia japonica* is used as a condiment. It is difficult to cultivate, making it expensive, and so it is frequently substituted with a mixture of horseradish, mustard, starch, and green food coloring. Wasabi is generally sold either as a root that is very finely grated before use, as dried powder in large quantities, or as a ready-to-use paste in tubes similar to travel

toothpaste tubes. The paste is prepared by grating the root with a fine grater about 10 minutes before serving. Once the paste is prepared and exposed to the air, it loses the potency of its flavor after about 15 minutes if left uncovered. Fresh wasabi leaves can also be eaten, having the spicy flavor of wasabi roots.

Yukon Gold potato: A large variety of potato characterized by its smooth eye-free skin and yellow-tinged flesh. It is a useful all-purpose potato, standing up to both dry-heat and wet-heat cooking methods. Its waxy moist flesh and sweet flavor make it ideal for boiling, baking, and frying but it also does well with grilling, pan frying, and roasting. Yukon Gold potatoes were developed in the 1960s at the University of Guelph, Ontario, Canada, from potatoes Yema de huevo (a traditional bright yellow-fleshed Central American potato), Katahdin (a low-starch, thin-skinned, waxy-fleshed variety developed in Maine in the 1930s), and Norgleam (an all-purpose white-fleshed potato developed in North Dakota in the 1950s).

A

BOUT REINDEER

Reindeer have been feeding people for thousands of years. Domestic reindeer (*Rangifer tarandus tarandus*) are members of the genus *Rangifer*, which is the most widely used food animal in the circumpolar North. We are not sure when or where reindeer were originally domesticated, possibly in more than one location in Asia. Although they do not look like it with their thick coats and impressive antlers, they are a true livestock animal. Many northern peoples depend upon reindeer for their clothing, transportation, food, and, in some cases, companionship. A diversity of peoples consisting of Saami, Russians, Asians, and Inupiat can be seen herding reindeer across the tundra landscapes of the world. Reindeer are their most cherished possessions.

So what is unique about reindeer, and how are they different from more recognized livestock species like cattle, sheep, or goats? The most important thing about reindeer is that they are adapted to the sub-Arctic and Arctic: they have an exceptionally warm winter coat; they consume snow rather than water in winter; they have large appetites in summer when natural forage is available, and need much less food in winter. All of

these characteristics make them the better livestock choice to raise in the North.

Reindeer are much more sedentary than caribou and demonstrate fidelity to an area. Although reindeer do exhibit seasonal grazing patterns, their movements remain primarily within a home range, which allows for close herding by humans. When herded, reindeer gather together into a cohesive unit instead of spreading out. Alaska reindeer have been bred as meat producers; they have a more robust, squared body shape, with shorter legs and a high meat-to-bone ratio much like Angus cattle.

The nutritional status of reindeer varies tremendously during the year. In summer, when green vegetation is abundant, reindeer eat large quantities of highly nutritious plants. It is during this time that reindeer grow antlers, a new coat of hair, and muscle, and deposit large pads of fat beneath the skin of the rump and back. These muscle and fat deposits enable the reindeer to survive the long, cold winter, when food supplies are scarce. It is a curious fact that reindeer eat less food in winter than in summer, unlike other livestock. This fact holds true even when reindeer have

access to an abundance of nutritious food. It is also strange but true that reindeer become very sedentary and expend less energy during the winter, almost always losing body weight and body substance (muscle and fat). We now know that reindeer have evolved to survive by using their muscle and fat for essential body functions and by living a sedentary rather than a highly active life during the wintertime.

Perhaps the most important adaptation of reindeer for life in the North is the reindeer's preference for and ability to digest lichens. In fact, of all the many kinds of forages, grasses, and livestock feeds tested to date, we have found that reindeer prefer lichens. Almost no other large arctic mammal eats lichen. The importance of this unique physiological adaptation cannot be overestimated. The sustained use of tundra rangeland, as well as calculations for carrying capacity and maximum herd size, is based on the availability of lichens for winter grazing.

There are at least three reasons why the reindeer's preference for lichens has enabled them to survive in the North. First, lichens usually constitute a major part of the vegetative biomass and, therefore, of the

food supply of the reindeer's winter tundra pastures. As other grazing mammals do not eat lichens (and provided these pastures are not overgrazed and that the reindeer are allowed to graze freely), the reindeer is guaranteed a supply of food for winter survival.

The second reason for the importance of lichens in the reindeer's diet is more complex. From a nutritionist's viewpoint, lichens are extremely deficient in protein, fat, minerals, and vitamins. In fact, lichens, like candy, pancakes, and potatoes, contain mostly carbohydrate. How can a high-carbohydrate diet have survival value for reindeer? We know that lichens, like most carbohydrates, are highly digestible. That means, first, that almost all the nutrients in lichens become available to the reindeer for the maintenance of body functions, mostly as energy. And second, because lichens contain only small amounts of protein and minerals, there are fewer metabolic wastes to be eliminated in urine. Why is this important? Stated quite simply, the elimination of body wastes in urine also requires the excretion of body water. But body water must be replaced, which means that the reindeer must eat more cold snow. This in turn robs body heat

because the snow has to be heated to body temperature. Reindeer are ruminants: they have a rumen full of microbes which break down the forages that a reindeer eats. Reindeer have to "share" the energy and nutrients they gain from their food with this large population of microbes. We have found the special microbes in the rumen that digest lichen are very good at breaking down the lichen but not very good at using the metabolites for energy. Thus, the reindeer gets a proportionally larger share of the energy than the microbes in their rumen from lichen than other foods. Does this mean that lichens are the best of all possible rations for winter survival of reindeer? Not at all. Reindeer do very well on milled feeds, but such feeds are not usually available to most reindeer in winter. Our third reason, then, is that reindeer have adapted to an ecological niche, i.e., lichen pastures, in which there are no competitors for their preferred winter food resource. The high energy value of lichens can be traced to lower energy-sharing costs with microbes and their low content of minerals and proteins. This in turn enables the reindeer to conserve energy by more efficient use of the food and heating less body water.

Reindeer milk is extremely high in fat and protein. Only sea mammals such as seals secrete more nutrient-concentrated milk. Newborn reindeer calves start to nurse their mothers almost immediately after birth. The highly nutritious milk enables the calves to grow and develop very rapidly and provides the energy needed to follow their mothers, who are almost constantly moving in search of food, seeking shelter from wind and cold, or escaping from predators. The birth weight of reindeer calves typically ranges from 6-8 kilograms. They grow quickly, about 0.5 kilograms per day, and weigh between 65 and 75 kilograms by the time they are yearlings. As adults, females (nonpregnant) weigh from 70-90 kilograms while males weigh 90-120 kilograms, depending on the season.

Female reindeer typically reach reproductive maturity as yearlings, though it is possible for a female to become impregnated during the fall of her first year and give birth as a yearling. Females may stay productive for a dozen years or more. Bulls don't fully exhibit the characteristics of rut until about three years of age. Because they are unable to compete with other

bulls prior to this, they rarely breed successfully as very young animals. They are, however, reproductively viable by the time they are yearlings. In the absence of older bulls, they are capable of servicing females, though they are able to maintain only a small harem. Bulls typically don't live past about eight years of age. Breeding season for reindeer happens during August and September. Gestation lasts for 200-220 days and females will begin to give birth in April and continue into May. The reproductive cycle of North American caribou is about a month behind that of reindeer.

Rangifer tarandus is the only deer species in which both the males and females grow antlers. Antlers, by definition, are shed and regrown every year. Bulls lose their antlers during the winter, typically around the solstice or shortly after. Non-pregnant females will also lose their antlers during the winter. Pregnant females will not drop their antlers until they give birth in the spring.

Reindeer are raised for their antlers, hide, milk, meat, etc. In some cultures, velvet antler is used medicinally and reindeer milk and cheese are staples. Hides are converted into clothing and a diversity of

handicrafts. In the regions of the circumpolar North where they abide (Alaska, Canada, Norway, Sweden, Finland, Siberia), the thousands of years of indigenous knowledge and investment in breeding has now been supplemented by modern university research into reindeer genetics, nutrition, husbandry, reproduction, range management, meat science, and, as in this volume, culinary preparation. Reindeer, like other domestic animals, offer far more than their meat—but what a delicious offering it is.

R EINDEER NUTRITION FACTS

Data taken from: Rincker, P.J., Bechtel, P.J., Finstad, G., van Buuren, R.G.C., Killefer, J & McKeith, F.K. 2006.

Similarities and differences in composition and selected sensory attributes of reindeer, caribou and beef. Journal of Muscle Foods 17, 65-78.

Reindeer Meat Composition

	Raw	Cooked
Fat %	3.8	4.46
Protein %	26	31
Moisture %	72	66
Cholesterol g/100g	2.1	2.1

Reindeer Meat Lipid Class Composition

	Raw	Cooked
triglycerides %	45.5	42
free fatty acids %	2.7	1.13
phospholipids %	49.9	55.13

Values of Selected Traits from Beef, Caribou, and Reindeer

	Beef	Caribou	Reindeer
Glycogen + glucose + G-6-P (mmole/g)	18.07	58.93	49.29
Lactic acid (mmole/g)	82.96	62.83	64.37
Glycolytic potential (mmole/g)	119.1	180.69	162.96
Fat (%)	4.02	1.18	2.76
Moisture (%)	72.82	73.8	73.83
Myoglobin (mg/g)	7.29	8.59	9.79
pH	5.48	5.61	5.60

Sensory characteristics

Juiciness	8.13	8.04	8.83
Tenderness	8.57	10.2	9.58
Meat-flavor intensity	7.12	5.9	6.03
Off-flavor intensity	0.76	3.21	2.75
Shear force (kg) at 65°C	1.30	1.28	1.13
Shear force (kg) at 75°C	1.52	1.18	1.30

Reindeer Meat Fatty Acids

	Raw	Cooked		Raw	Cooked
C14:0	1.2	1.2	MUFA	38	37.2
C16:0	23.6	24.7	PUFA	13.8	13.5
C16:1 n-7	1.1	1.1	P/S ratio	0.29	0.27
C17:0	0.67	0.67	n-6 PUFA	12.6	12.6
C18:0	18.9	19.3	n-3 PUFA	1.16	0.96
C18:1 n-9 cis	24.3	34.4	n-6/n-3	14.2	19.2
C18:2 n-6 cis	8	8.6			
C18:3 n-3	0.53	0.47			
C20:0	0.21	0.19			
C20:2 n-6	0.27	0.26			
C20:3 n-6	0.29	0.27			
C20:4 n-6	3.37	2.8			
C20:5 n-3	0.45	0.33			
C24:0	1.06	0.79			
C22:6 n-3	0.21	0.13			
SFA	48.2	49.2			

C

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HANK YOU



Alaska Native–Native Hawai‘ian grant #G00005015,
USDA Drumbeats 6 Haaghezelonó

University of Alaska Drumbeat Alaska Consortium Award
#2014-38426-22026

USDA-NIFA grant #AHSI-005541



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ISBN: 978-0-692-73865-8