Analysis of Campbell's® and Progresso® Soups

Part II

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The purpose of this project is to gather data in order to determine whether there is a significant, healthful difference when consuming *Campbell's® Chunky* soups versus their healthier option, *Campbell's® Homestyle* soups. The study will also explore another brand option, the healthier *Progresso® Traditional* soups of the *Progresso®* soup line, where a comparison to *Campbell's® Homestyle* soups will be formulated as well. During the research process, values such as sodium per serving, total fat per serving and calories per serving will be recorded, analyzed, charted and graphed. Tests will be performed comparing, specifically, the caloric means of both *Campbell's®* soup brands and the *Progresso® Traditional* soups, where the results will be analyzed in other to determine if there is any significance between the means. Based on the data collected for this sample, the findings should conclude as to whether there is a superior soup choice in regards to health, especially calories, within the three brands surveyed. A possible interpretation could be that *Campbell's® Homestyle* or *Progresso® Traditional* soups will fare more nutritional results, since they both claim to be healthier options. Yet, as to which is more beneficial for both budget and health and have the best caloric average per soup brand, the data presented in this paper will hope to shed clarification on the matter.

The approach taken was to collect the data from various soups brands and compare which overall product line was healthier and cost less. The plan was implemented by having a student, Jeff, collect the data by gathering the following data sets: cost, sodium per serving size, fat per serving size, and calories per serving. The following charts and calculations will illustrate the findings of the data.

CAMPBELL'S CHUNKY SOUPS

#	CAMPBELL'S CHUNKY SOUP SAMPLES	COST/CAN @ RALPH'S	SERVING SIZE	SODIUM/SERVING (GRAMS)	FAT/SERVING (GRAMS)	CALORIES/SERVING
1	Sausage and Pepper Rigatoni	$2.69	1 cup = 236 g	0.79	8.00	190.00
2	Beer-n-Cheese with Beef & Bacon	$2.69	1 cup = 236 g	0.79	9.00	190.00
3	Pub-Style Chicken Pot Pie	$2.69	1 cup = 236 g	0.79	9.00	180.00
4	Jazzy Jambalaya with Chicken, Sausage and Ham	$2.69	1 cup = 236 g	0.79	4.00	140.00
5	Mushroom Swiss Burger	$2.69	1 cup = 236 g	0.79	7.00	160.00
6	Classic Chicken Noodle	$2.69	1 cup = 236 g	0.79	3.00	110.00
7	New England Clam Chowder	$2.69	1 cup = 236 g	0.89	10.00	180.00
8	Sirloin Burger with Country Vegetable	$2.69	1 cup = 236 g	0.79	5.00	140.00
9	Creamy Chicken and Dumplings	$2.69	1 cup = 236 g	0.89	8.00	160.00
10	Baked Potato with Cheddar & Bacon Bits Made with Fresh & Baked Potatoes	$2.69	1 cup = 236 g	0.79	9.00	190.00
11	Grilled Chicken and Sausage Gumbo	$2.69	1 cup = 236 g	0.85	4.00	150.00
12	Steak & Potato	$2.69	1 cup = 236 g	0.89	2.00	110.00
13	Old Fashioned Vegetable Beef	$2.69	1 cup = 236 g	0.89	3.00	120.00
14	Beef with Country Vegetables	$2.69	1 cup = 236 g	0.86	3.00	120.00
15	Chicken Broccoli Cheese with Potato	$2.69	1 cup = 236 g	0.89	12.00	190.00
16	Grilled Sirloin Steak with Hearty Vegetables	$2.69	1 cup = 236 g	0.89	2.00	120.00
17	Split Pea & Ham with Natural Smoked Flavor	$2.69	1 cup = 236 g	0.79	2.00	150.00
18	Savory Pot Roast	$2.69	1 cup = 236 g	0.79	1.00	120.00
19	Savory Chiken with White and Wild Rice	$2.69	1 cup = 236 g	0.81	2.00	110.00
20	Hearty Beef Barley	$2.69	1 cup = 236 g	0.79	1.00	140.00
21	Hearty Bean & Ham with Natural Smoked Flavor	$2.69	1 cup = 236 g	0.78	1.50	170.00
22	Hearty Beef Noodle	$2.69	1 cup = 236 g	0.67	2.00	120.00
23	Roasted Beef Tips with Vegetables	$2.69	1 cup = 236 g	0.79	1.00	110.00
24	Hearty Italian-Style Wedding with Meatballs & Spinach	$2.69	1 cup = 236 g	0.79	3.00	120.00
25	Old Fashioned Potato Ham Chowder	$2.69	1 cup = 236 g	0.80	9.00	170.00
26	Fajita Chicken with Rice and Beans	$2.69	1 cup = 236 g	0.85	1.00	130.00
27	Hearty Tomato with Pasta	$2.69	1 cup = 236 g	0.65	1.00	150.00
28	Slow Roasted Beef with Mushrooms	$2.69	1 cup = 236 g	0.79	1.00	110.00
29	Beef and Dumplings with Hearty Vegetables	$2.69	1 cup = 236 g	0.80	1.50	130.00
30	Baked Potato with Steak & Cheese Made with Fresh & Baked Potatoes	$2.69	1 cup = 236 g	0.85	9.00	210.00
31	Hearty Chicken with Vegetables	$2.69	1 cup = 236 g	0.83	1.00	90.00
32	Salisbury Steak Mushrooms and Onions	$2.69	1 cup = 236 g	0.79	3.50	130.00
33	Grilled Chicken with Vegetables and Pasta	$2.69	1 cup = 236 g	0.85	2.00	100.00
34	Beef Rib Roast with Potatoes and Herbs	$2.69	1 cup = 236 g	0.89	1.50	110.00
35	Manhattan Clam Chowder	$2.69	1 cup = 236 g	0.80	3.00	120.00
36	Beef with White and Wild Rice	$2.69	1 cup = 236 g	0.89	1.50	140.00
37	Savory Vegetable	$2.69	1 cup = 236 g	0.77	0.50	100.00
38	Jammin' Jerk Chicken with Rice and Beans	$2.69	1 cup = 236 g	0.79	1.50	140.00
39	Kickin' Buffalo-Style Chicken	$2.69	1 cup = 236 g	0.79	6.00	130.00
40	Chipotle Chicken & Corn Chowder	$2.69	1 cup = 236 g	0.79	8.00	180.00
41	Chicken Corn Chowder	$2.69	1 cup = 236 g	0.86	10.00	190.00

DATA SUMMARY	SODIUM/SERVING (GRAMS)	TOTAL FAT/SERVING (GRAMS	CALORIES/SERVING
$\sum X$	33.37	172.50	5,820.00
$\sum X^2$	27.28	1,182.75	865,400.00
MEAN	0.81	4.21	141.95
MODE	0.79	1.00	120.00
STANDARD DEVIATION	0.05	3.38	31.32
MINIMUM	0.65	0.50	90.00
Q1	0.79	1.50	120.00
MEDIAN	0.79	3.00	140.00
Q3	0.85	8.00	170.00
MAXIMUM	0.89	12.00	210.00
LOWER FENCE	0.70	-8.25	45.00
UPPER FENCE	0.94	17.75	245.00

CAMPBELL'S HOMESTYLE SOUPS

#	CAMPBELL'S HOMESTYLE SOUP SAMPLES	COST/CAN @ RALPH'S	SERVING SIZE	SODIUM/SERVING (GRAMS)	TOTAL FAT/SERVING (GRAMS)	CALORIES/SERVING
1	Butternut Squash Bisque	$2.79	1 cup = 236 grams	0.65	3.00	110.00
2	Chicken Noodle	$2.79	1 cup = 236 grams	0.79	2.50	90.00
3	Chicken with White & Wild Rice	$2.79	1 cup = 236 grams	0.79	1.00	100.00
4	Creamy Chicken & Herb Dumplings	$2.79	1 cup = 236 grams	0.79	9.00	160.00
5	Creamy Chicken Alfredo	$2.79	1 cup = 236 grams	0.79	12.00	190.00
6	Creamy Gouda Bisque with Chicken	$2.79	1 cup = 236 grams	0.79	11.00	190.00
7	Creole-Style Chicken with Red Beans & Rice	$2.79	1 cup = 236 grams	0.65	3.00	130.00
8	Harvest Tomato with Basil	$2.79	1 cup = 236 grams	0.79	1.00	110.00
9	Italian-Style Wedding	$2.79	1 cup = 236 grams	0.79	3.50	120.00
10	Maryland-Style Crab	$2.79	1 cup = 236 grams	0.79	0.50	80.00
11	Mexican-Style Chicken Tortilla	$2.79	1 cup = 236 grams	0.85	2.00	130.00
12	Minestrone	$2.79	1 cup = 236 grams	0.79	1.00	100.00
13	New England Clam Chowder	$2.79	1 cup = 236 grams	0.89	10.00	170.00
14	Potato Broccoli Cheese	$2.79	1 cup = 236 grams	0.79	10.00	170.00
15	Southwest-Style Potato with Green Chilies & Cheese	$2.79	1 cup = 236 grams	0.79	7.00	160.00
16	Southwest-Style White Chicken Chili	$2.79	1 cup = 236 grams	0.65	2.50	130.00
17	Spicy Southwest-Style Chicken Noodle	$2.79	1 cup = 236 grams	0.79	1.00	100.00
18	Tuscany-Style Chicken and Pasta	$2.79	1 cup = 236 grams	0.79	1.00	90.00
19	Vegetable Medley	$2.79	1 cup = 236 grams	0.79	0.50	90.00
20	Zesty Tomato Bisque	$2.79	1 cup = 236 grams	0.65	2.00	110.00

DATA SUMMARY	SODIUM/SERVING (GRAMS)	TOTAL FAT/SERVING (GRAMS)	CALORIES/SERVING
$\sum X$	15.40	83.50	2,530.00
$\sum X^2$	11.94	651.25	343,300.00
MEAN	0.77	4.18	126.50
MODE	0.79	1.00	110.00
STANDARD DEVIATION	0.07	3.99	34.98
MINIMUM	0.65	0.50	80.00
Q1	0.79	1.00	100.00
MEDIAN	0.79	2.50	115.00
Q3	0.79	7.50	160.00
MAXIMUM	0.89	12.00	190.00
LOWER FENCE	0.79	-8.75	10.00
UPPER FENCE	0.79	17.25	250.00

Test of Normality for Calories in Campbell's Chunky Soup

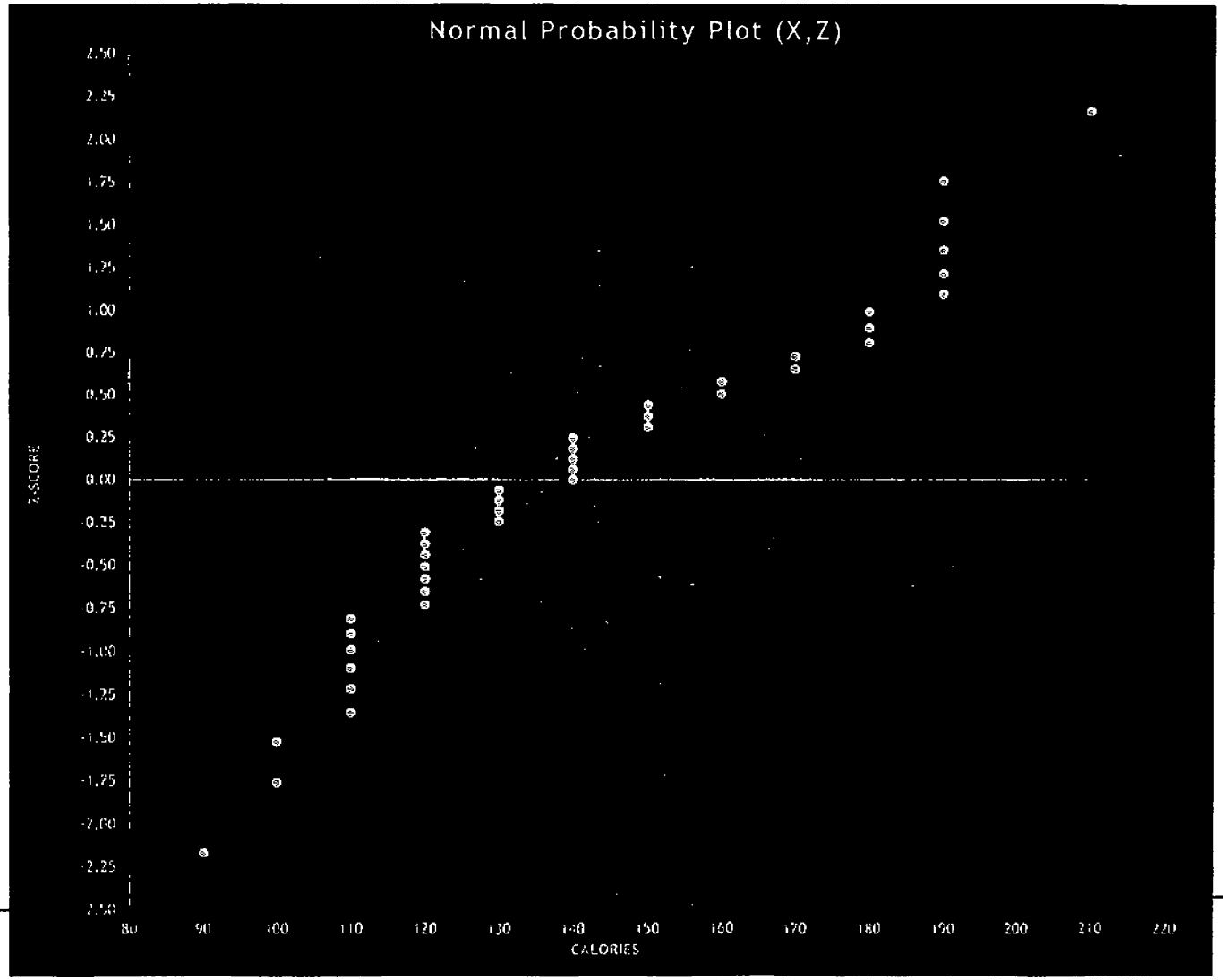
Soup Flavor	Sorted Calories per Serving (X)	Position (i)	$f_i =$	Z-Score of f_i (Z)
Hearty Chicken with Vegetables	90	1	0.0151515152	-2.1661067529
Grilled Chicken with Vegetables and Pasta	100	2	0.0393939394	-1.7577627917
Savory Vegetable	100	3	0.0636363636	-1.5249453578
Classic Chicken Noodle	110	4	0.0878787879	-1.3539335591
Steak & Potato	110	5	0.1121212121	-1.2153243083
Savory Chiken with White and Wild Rice	110	6	0.1363636364	-1.0968035621
Roasted Beef Tips with Vegetables	110	7	0.1606060606	-0.9919700796
Slow Roasted Beef with Mushrooms	110	8	0.1848484848	-0.8970411309
Beef Rib Roast with Potatoes and Herbs	110	9	0.2090909091	-0.8095796321
Old Fashioned Vegetable Beef	120	10	0.2333333333	-0.7279132909
Beef with Country Vegetables	120	11	0.2575757576	-0.6508373064
Grilled Sirloin Steak with Hearty Vegetables	120	12	0.2818181818	-0.5774487300
Savory Pot Roast	120	13	0.3060606061	-0.5070478967
Hearty Beef Noodle	120	14	0.3303030303	-0.4390765630
Hearty Italian-Style Wedding with Meatballs & Spinach	120	15	0.3545454545	-0.3730773052
Manhattan Clam Chowder	120	16	0.3787878788	-0.3086658057
Fajita Chicken with Rice and Beans	130	17	0.4030303030	-0.2455112402
Beef and Dumplings with Hearty Vegetables	130	18	0.4272727273	-0.1833218966
Salisbury Steak Mushrooms and Onions	130	19	0.4515151515	-0.1218342315
Kickin' Buffalo-Style Chicken	130	20	0.4757575758	-0.0608041923
Jazzy Jambalaya with Chicken, Sausage and Ham	140	21	0.5000000000	0.0000000000
Sirloin Burger with Country Vegetable	140	22	0.5242424242	0.0608041923
Hearty Beef Barley	140	23	0.5484848485	0.1218342315
Beef with White and Wild Rice	140	24	0.5727272727	0.1833218966
Jammin' Jerk Chicken with Rice and Beans	140	25	0.5969696970	0.2455112402
Grilled Chicken and Sausage Gumbo	150	26	0.6212121212	0.3086658057
Split Pea & Ham with Natural Smoked Flavor	150	27	0.6454545455	0.3730773052
Hearty Tomato with Pasta	150	28	0.6696969697	0.4390765630
Mushroom Swiss Burger	160	29	0.6939393939	0.5070478967
Creamy Chicken and Dumplings	160	30	0.7181818182	0.5774487300
Hearty Bean & Ham with Natural Smoked Flavor	170	31	0.7424242424	0.6508373064
Old Fashioned Potato Ham Chowder	170	32	0.7666666667	0.7279132909
Pub-Style Chicken Pot Pie	180	33	0.7909090909	0.8095796321
New England Clam Chowder	180	34	0.8151515152	0.8970411309
Chipotle Chicken & Corn Chowder	180	35	0.8393939394	0.9919700796
Sausage and Pepper Rigatoni	190	36	0.8636363636	1.0968035621
Beer-n-Cheese with Beef & Bacon	190	37	0.8878787879	1.2153243083
Baked Potato with Cheddar & Bacon Bits Made with Fresh & Baked Potatoe	190	38	0.9121212121	1.3539335591
Chicken Broccoli Cheese with Potato	190	39	0.9363636364	1.5249453578
Chicken Corn Chowder	190	40	0.9606060606	1.7577627917
Baked Potato with Steak & Cheese Made with Fresh & Baked Potatoes	210	41	0.9848484848	2.1661067529
		n = 41	$f_i = \frac{i - 0.375}{n + 0.25}$	

Campbell's Chunky Soup

r = Correlation (X) and (Z)
0.9703850270

Critical Value = $1.0063 - 0.6118/n + 1.3505/n^2 - 0.1288/\sqrt{n}$
0.9589710695

Since r > Critical Value, the data set is nearly normally distributed



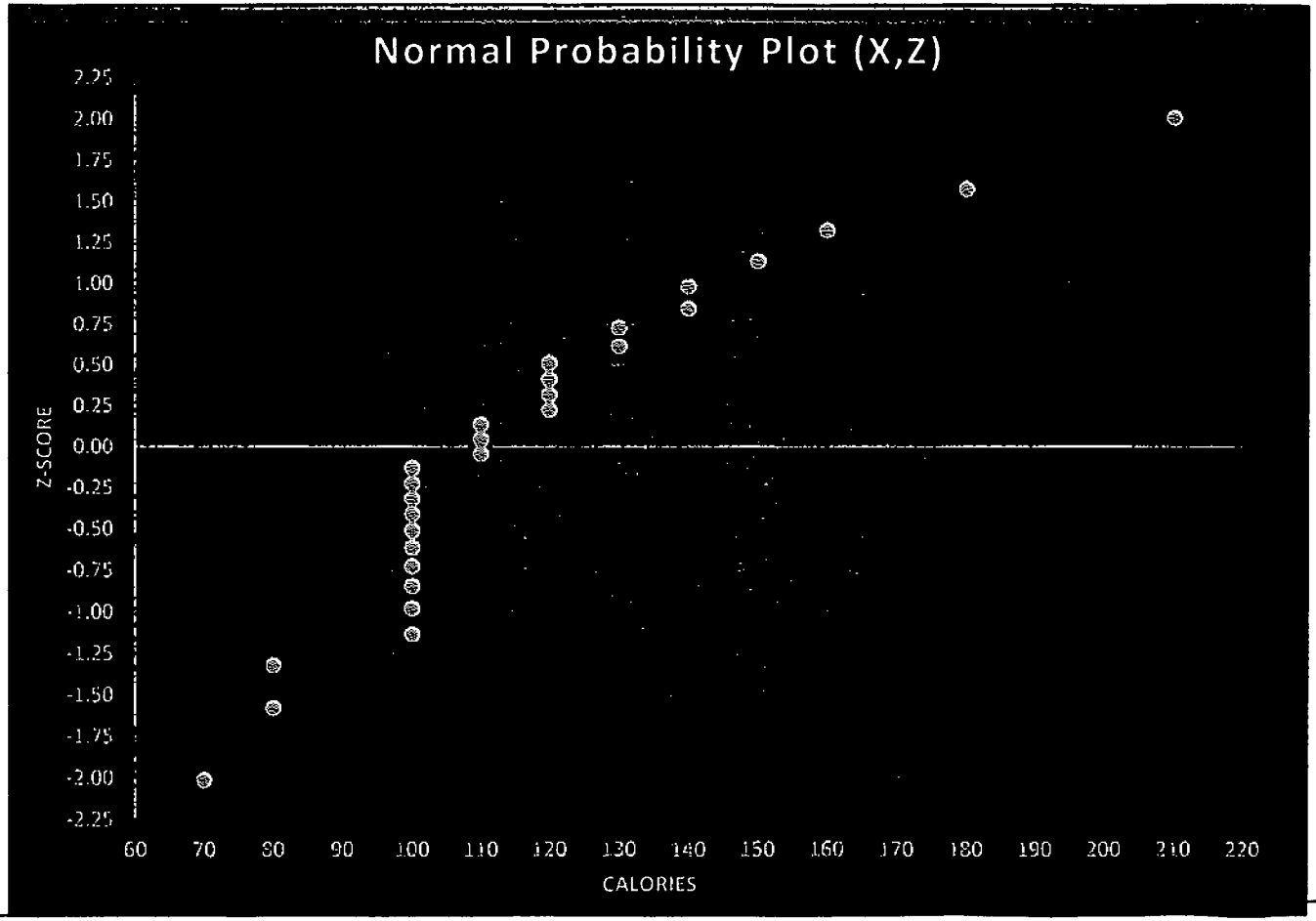
Test of Normality for Calories in Progresso Traditional Soup

Soup Flavor	Sorted Calories per Serving (X)	Position (i)	f_i =	Z-Score of f_i (Z)
Turkey Noodle	70	1	0.0221238938	-2.0117358670
Roasted Chicken Rontini	**80**	**2**	**0.0575221239**	**-1.5759199712**
Roasted Chicken with Garlic	80	3	0.0929203540	-1.3229839723
Beef Barley	**100**	**4**	**0.1283185841**	**-1.1343752695**
Beef & Vegetable	100	5	0.1637168142	-0.9792962388
Chicken Barley	**100**	**6**	**0.1991150442**	**-0.8447864372**
Chicken & Herb Dumpling	100	7	0.2345132743	-0.7240638306
Chicken & Orzo with Lemon	**100**	**8**	**0.2699115044**	**-0.6130806578**
Hearty Chicken & Rotini	100	9	0.3053097345	-0.5091894047
Homestyle Chicken with Vegetables and Pearl Pasta	**100**	**10**	**0.3407079646**	**-0.4105317344**
Manhattan Clam Chowder	100	11	0.3761061947	-0.3157234981
Roasted Chicken Primavera	**100**	**12**	**0.4115044248**	**-0.2236767357**
Chicken Noodle	100	13	0.4469026549	-0.1334907114
Chicken Rice with Vegetables	**110**	**14**	**0.4823008850**	**-0.0443796659**
Chicken Tortilla	110	15	0.5176991150	0.0443796659
Southwestern Style Chicken	**110**	**16**	**0.5530973451**	**0.1334907114**
Chicken & Sausage Gumbo	120	17	0.5884955752	0.2236767357
Chicken & Wild Rice	**120**	**18**	**0.6238938053**	**0.3157234981**
Chicken Tuscany	120	19	0.6592920354	0.4105317344
Italian-Style Wedding	**120**	**20**	**0.6946902655**	**0.5091894047**
Chickarina with Meatballs	130	21	0.7300884956	0.6130806578
Meatball & Rice	**130**	**22**	**0.7654867257**	**0.7240638306**
Creamy Roasted Chicken with Herb Dumpling	140	23	0.8008849558	0.8447864372
Split Pea with Ham	**140**	**24**	**0.8362831858**	**0.9792962388**
Creamy Tomato with Bacon and Cheese	150	25	0.8716814159	1.1343752695
Chicken Cheese Enchilada Flavor	**160**	**26**	**0.9070796460**	**1.3229839723**
New England Clam Chowder	180	27	0.9424778761	1.5759199712
Potato Broccoli & Cheese Chowder	**210**	**28**	**0.9778761062**	**2.0117358670**
		n = 28	$f_i = \frac{i - 0.375}{n + 0.25}$	

Progressoo Traditional Soup

r = Correlation (X) and (Z)	Critical Value = $1.0063 - 0.6118/n + 1.3505/n^2 - 0.1288/\sqrt{n}$
0.9345394377	0.9547453379

Since r < Critical Value, the data set is <u>not</u> nearly normally distributed



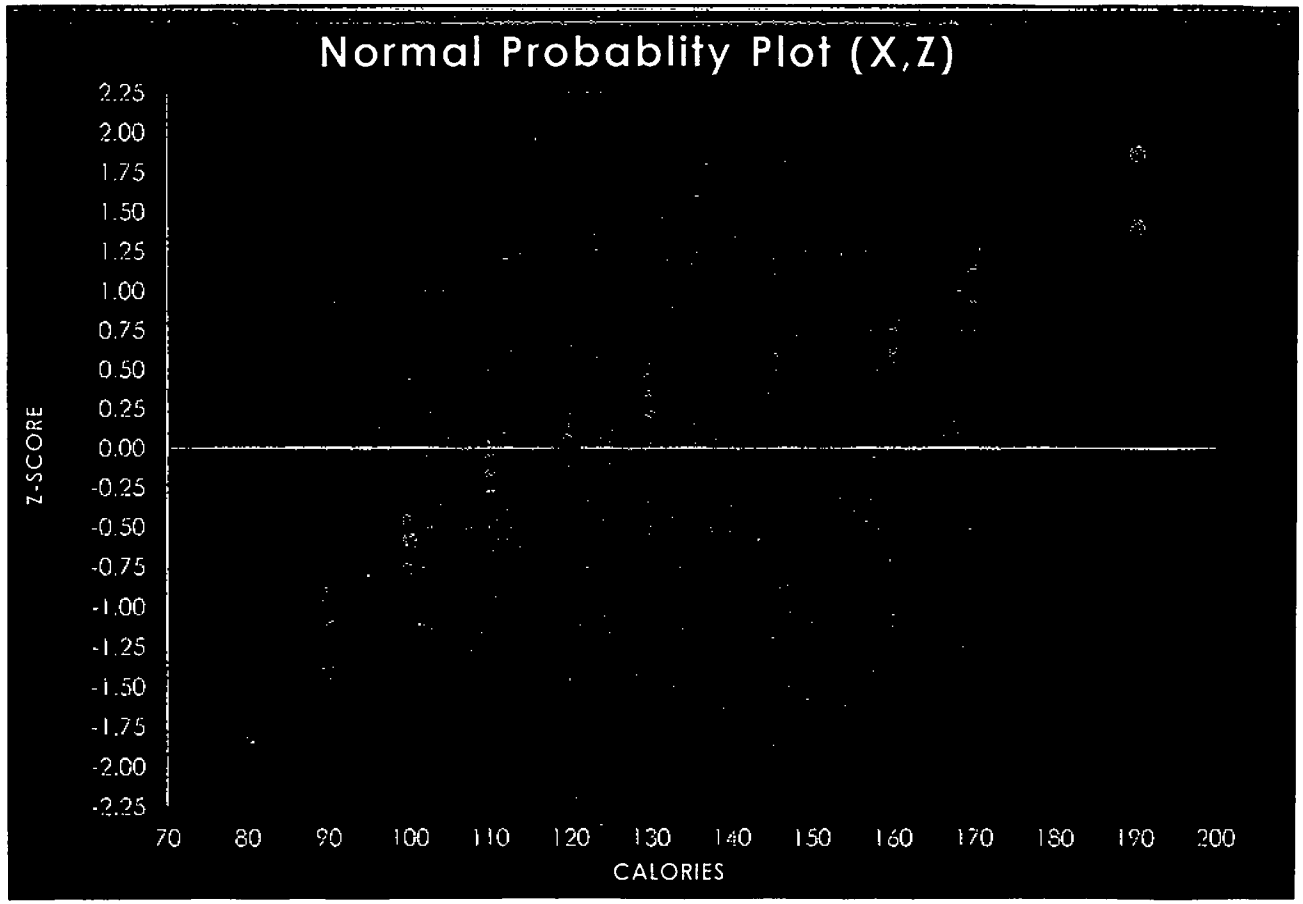
Test of Normality for Calories in Campbell's Homestyle Soup

Soup Flavor	Calories	i	$f_i = \frac{i - 0.375}{n + 0.25}$	z_i
Maryland-Style Crab	80	1	0.0308641975	-1.8682416549
Chicken Noodle	90	2	0.0802469136	-1.4034126359
Tuscany-Style Chicken and Pasta	90	3	0.1296296296	-1.1281436453
Vegetable Medley	90	4	0.1790123457	-0.9191355220
Chicken with White & Wild Rice	100	5	0.2283950617	-0.7441427422
Minestrone	100	6	0.2777777778	-0.5894557978
Spicy Southwest-Style Chicken Noodle	100	7	0.3271604938	-0.4477675185
Butternut Squash Bisque	110	8	0.3765432099	-0.3145722918
Harvest Tomato with Basil	110	9	0.4259259259	-0.1867561211
Zesty Tomato Bisque	110	10	0.4753086420	-0.0619316235
Italian-Style Wedding	120	11	0.5246913580	0.0619316235
Creole-Style Chicken with Red Beans & Rice	130	12	0.5740740741	0.1867561211
Mexican-Style Chicken Tortilla	130	13	0.6234567901	0.3145722918
Southwest-Style White Chicken Chili	130	14	0.6728395062	0.4477675185
Creamy Chicken & Herb Dumplings	160	15	0.7222222222	0.5894557978
Southwest-Style Potato with Green Chilies & Cheese	160	16	0.7716049383	0.7441427422
New England Clam Chowder	170	17	0.8209876543	0.9191355220
Potato Broccoli Cheese	170	18	0.8703703704	1.1281436453
Creamy Chicken Alfredo	190	19	0.9197530864	1.4034126359
Creamy Gouda Bisque with Chicken	190	20	0.9691358025	1.8682416549
		n = 20		

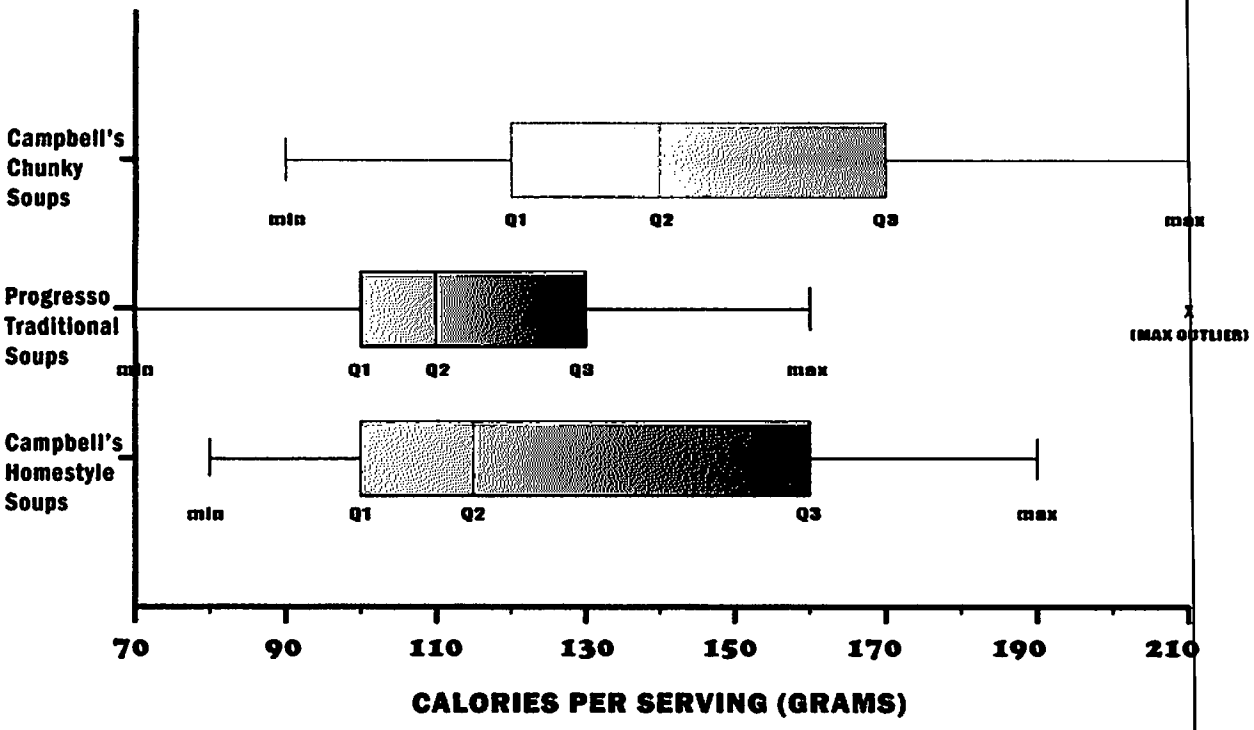
Campbell's Homestyle Soup

r = Correlation (X) and (Z)	Critical Value = $1.0063 - 0.6118/n + 1.3505/n^2 - 0.1288/\sqrt{n}$
0.9583972464	0.9502856944

Since r > Critical Value, the data set is nearly normally distributed.

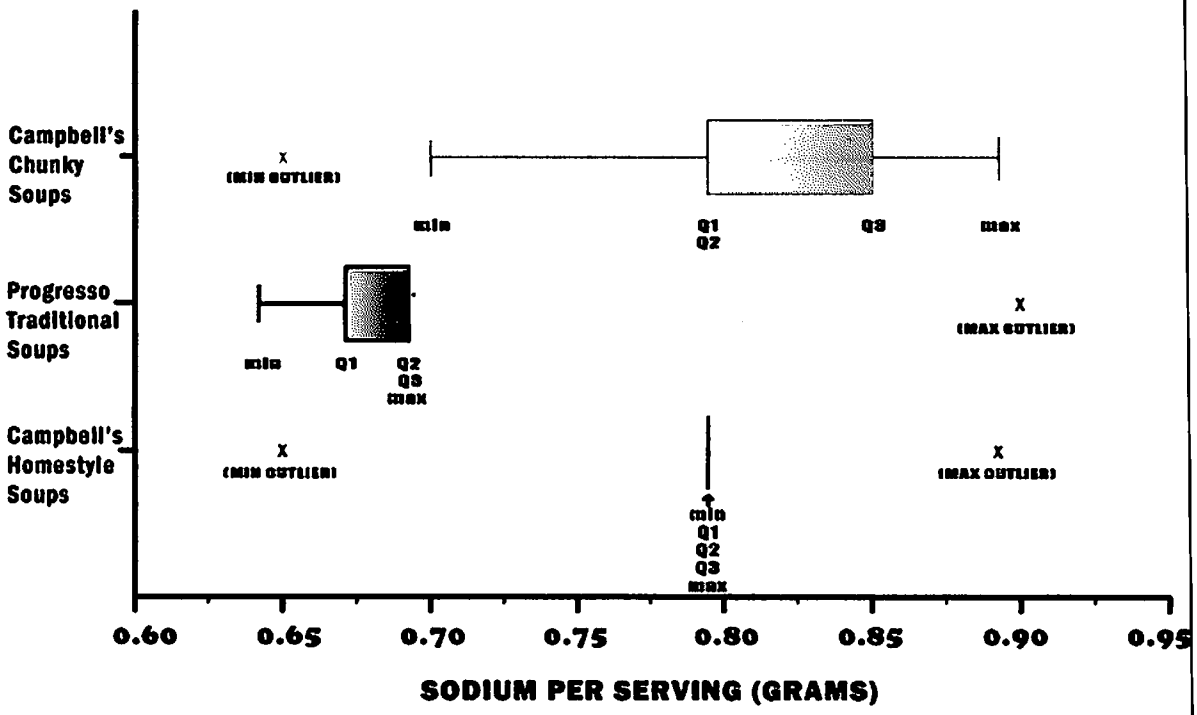


Calories Per Serving Comparison



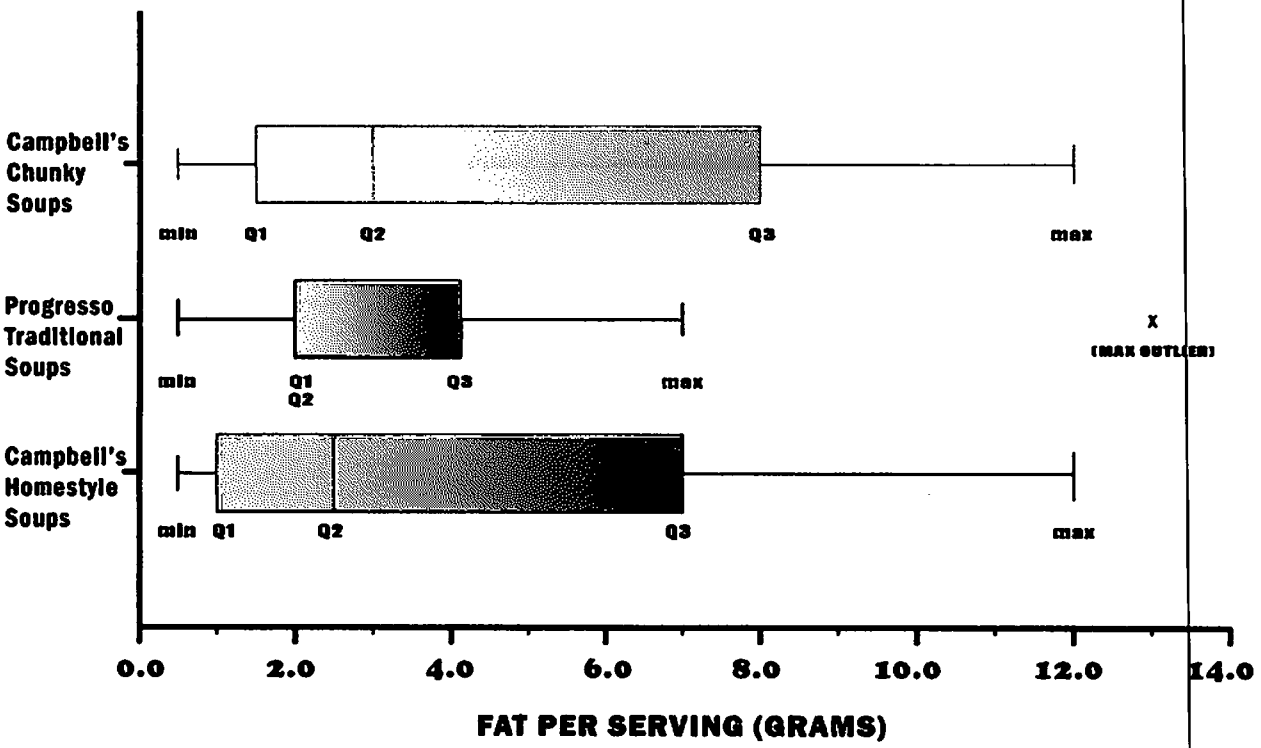
CAMPBELL'S CHUNKY SOUPS	PROGRESSO TRADITIONAL SOUPS	CAMPBELL'S HOMESTYLE SOUPS
MinX = 90.00	MinX = 70.00	MinX = 80.00
Q1 = 120.00	Q1 = 100.00	Q1 = 100.00
Q2 = 140.00	Q2 = 110.00	Q2 = 115.00
Q3 = 170.00	Q3 = 130.00	Q3 = 160.00
MaxX = 210.00	MaxX = 160.00	MaxX = 190.00
IQR = 50.00	IQR = 30.00	IQR = 60.00
Lower Fence = 45.00	Lower Fence = 55.00	Lower Fence = 10.00
Upper Fence = 245.00	Upper Fence = 175.00	Upper Fence = 250.00
Min Outlier = None	Min Outlier = None	Min Outlier = None
Max Outlier = None	Max Outlier = 210.00	Max Outlier = None

Sodium Per Serving Comparison



CAMPBELL'S CHUNKY SOUPS	PROGRESSO TRADITIONAL SOUPS	CAMPBELL'S HOMESTYLE SOUPS
MinX = 0.70	MinX = 0.64	MinX = 0.79
Q1 = 0.79	Q1 = 0.67	Q1 = 0.79
Q2 = 0.79	Q2 = 0.69	Q2 = 0.79
Q3 = 0.85	Q3 = 0.69	Q3 = 0.79
MaxX = 0.89	MaxX = 0.69	MaxX = 0.79
IQR = 0.06	IQR = 0.02	IQR = 0.00
Lower Fence = 0.70	Lower Fence = 0.64	Lower Fence = 0.79
Upper Fence = 0.94	Upper Fence = 0.72	Upper Fence = 0.79
Min Outlier = 0.65	Min Outlier = None	Min Outlier = 0.65
Max Outlier = None	Max Outlier = 0.90	Max Outlier = 0.89

Fat Per Serving Comparison



CAMPBELL'S CHUNKY SOUPS	PROGRESSO TRADITIONAL SOUPS	CAMPBELL'S HOMESTYLE SOUPS
MinX = 0.50	MinX = 0.50	MinX = 0.50
Q1 = 1.50	Q1 = 2.00	Q1 = 1.00
Q2 = 3.00	Q2 = 2.00	Q2 = 2.50
Q3 = 8.00	Q3 = 4.13	Q3 = 7.50
MaxX = 12.00	MaxX = 7.00	MaxX = 12.00
IQR = 30.00	IQR = 2.13	IQR = 6.50
Lower Fence = -8.25	Lower Fence = -1.195	Lower Fence = -8.75
Upper Fence = 17.75	Upper Fence = 7.325	Upper Fence = 17.25
Min Outlier = None	Min Outlier = None	Min Outlier = None
Max Outlier = None	Max Outlier = 13.00	Max Outlier = None

Confidence Intervals:

Assume all data are normally distributed:

1. **Campbell's® Homestyle Soups**

$\bar{x}$=126.5, σ=34.099, n=20

a) 95% confidence level: Z(α/2)=1.96
b) b. margin of error: $E= Z(\alpha/2)* \sigma/(\sqrt{n}) = 1.96*34.099/(\sqrt{20}) = 14.945$
c) c. confidence interval: $\bar{x} - E \leq \mu \leq \bar{x} - E$

$$\mathbf{111.555 \leq \mu \leq 141.445}$$

We are 95% confidence that the calories of *Campbell's® Homestyle* soups lies between 111.555 / serving and 141.445/ serving.

2. **Campbell's® Chunky Soup**

$\bar{x}$=141.95, σ=30.94, n=41

a) 95% confidence level: Z(α/2)=1.96
b) b. margin of error: $E= Z(\alpha/2)* \sigma/(\sqrt{n}) = 1.96*31.94/(\sqrt{41}) = 9.7769$
c) c. confidence interval: $\bar{x} - E \leq \mu \leq \bar{x} - E$

$$\mathbf{132.1731 \leq \mu \leq 151.7269}$$

We are 95% confidence that the calories of *Campbell's® Chunky* soup lies between 132.1731 / serving and 151.7269/ serving.

Test Hypothesis:

Campbell's® Homestyle Soups	Campbell's Chunky Soups
$n_1 = 20$	$n_2 = 41$
$\bar{x}_1 = 126.5$	$\bar{x}_2 = 141.95$
$S_1 = 34.98$	$S_2 = 31.32$

1. In a random sample of 20 cans of *Campbell's® Homestyle* soups the mean calories is 126.5 and the standard deviation of 34.99 and a random sample of 41 cans of *Campbell's® Chunky* soups with a mean calories of 146.95 and a standard deviation of 31.32. Test a claim that *Campbell's® Homestyle* soups mean is different from that of *Campbell's® Chunky* soups. Assume that the differences are normally distributed.

   a) $H_o = \mu_1 = \mu_2$
      $H_a = \mu_1 \neq \mu_2$
   b) T-statistic:

$$\frac{(126.5 - 141.95)}{\sqrt{\frac{34.98^2}{20} + \frac{31.32^2}{41}}} = -1.67$$

   c) t-dist $df = 19$ $\alpha = 0.05$
      t-critical value = -167.19
   d) p-value 2 * tcdf(-1000, -1.67, 19)
      $= 0.111 > 0.05$
   e) We accept the null hypothesis H_o
   f) There is insufficient evidence at level of significance 0.05 that the mean of *Campbell's® Homestyle* soups is different from *Campbell's® Chunky* soups.

2. In a random sample of 20 cans of *Campbell's® Homestyle* soups with a mean of 126.5 and a standard deviation of 34.99 and a random sample of 41 cans of *Campbell's® Chunky* soups with a mean calories of 146.95 and a standard deviation of 31.32. Test a claim that *Campbell's® Homestyle* soups calories mean is higher than the mean calories *Campbell's® Chunky* soups. Assume that the differences are normally distributed. Use 0.05 significance level.

   a) $H_o = \mu_1 = \mu_2$
      $H_a = \mu_1 > \mu_2$
   b) T-statistic:

$$\frac{(126.5 - 141.95)}{\sqrt{\frac{34.98^2}{20} + \frac{31.32^2}{41}}} = -1.67$$

   c) t-dist $df = 19$ $\alpha = 1.729$
   d) p-value tcdf(-1000,-1.67,19)
      $= 0.0552 > 0.05$
   e) We accept the null hypothesis H_o
   f) There is insufficient evidence at level of significance 0.05 that the mean of *Campbell's® Homestyle* soups is higher than *Campbell's® Chunky* soups.

After analyzing and interpreting, in extensive detail, the data gathered from *Campbell's® Chunky* soups, *Campbell's® Homestyle* soups, and *Progresso® Traditional* soups, it was concluded that *Progresso® Traditional* soups at first appears to be considerably healthier than the comparative brands studied. Yet, when tested for normality, it did not have a very nice normal distribution. There were far too many outliers and irregular data that may be the cause as to why at first glance this brand appears to fare better and healthier. By healthier, the data proposes that there is, on average, less fat, less sodium and fewer calories per serving. When looking at calories specifically, it was not possible to be 95% confident that the average calories fall within a certain range for *Progresso® Traditional* soups. This is due to the lack of normality the distribution displayed. However, *Campbell's® Homestyle* soups and *Campbell's® Chunky* soups were normally distributed and comparisons were made between the two brands. We are 95% confident that *Campbell's® Homestyle* soups has, on average, fewer amount calories than *Campbell's® Chunky* soups. The caloric range for *Campbell's® Homestyle* soups is between 111.555 / serving and 141.445/ serving compared to *Campbell's® Chunky* soup's higher range of 132.1731 / serving and 151.7269/ serving. There is a significant difference in the lower range with a difference of around 20 calories and around 10 calories difference in the higher range. Therefore, based on calories, and a diet that requires a smaller caloric consumption, *Campbell's® Homestyle* soups would be a wiser choice, according to the confident interval testing. Although, after comparing the *Campbell's®* brands through hypothesis testing, there was insufficient evidence at the level of significance of 0.05 to conclude that *Campbell's® Homestyle* soup's mean is different or higher than that of *Campbell's® Chunky* soup. What this means is that although it appears that the healthier, *Campbell's® Homestyle* soup would be a better choice based on a confident interval, the actual hypothesis testing was inconclusive to support a claim that there are more calories or different amount of calories in *Campbell's® Homestyle* soup than that of *Campbell's® Chunky* soup. If one were to remove outliers from the data set, it could alter the means and normality quite a bit, making *Progresso® Traditional* soups a possible contender.

Based on data given for daily calorie values, it ranges from 1000 calories/day for small children to 2400 calories/day for males ages 19-30, the average being around 1800 calories/day. So a *Campbell's® Homestyle* soup can with an average of around 126 calories is 7% of the total recommended daily value, *Campbell's® Chunky* soup is at around 7.8% which is not a vast difference.