Revised results of 1996 FSIS Advanced Meat Recovery (AMR) survey, based on Agricultural Service Research (ARS) procedure for analyzing iron.

Comparison of the ARS Dry Ash and FSIS Wet Acid digestion iron results.

Table I provides the comparison of the results from the ARS Dry Ash and FSIS Wet Acid digestion results on 188 samples from the FSIS 1996 neckbone survey that were analyzed by both methods. The average ratio of ARS Dry Ash to FSIS Wet Acid digestion results is approximately 2.120. The average ration for hand deboned product is 2.104, and the average for AMR product is 2.125. An imputed ARS dry ash result for a sample when an ARS dry ash result for that sample was not available was determined by multiplying the FSIS Wet Acid digestion result for the sample by 2.12.

AMR product characteristics

Comments with data were received from various organizations, including the National Turkey Federation (NTF), the American Meat Institute (AMI), and corporations, EXCEL, BEEF inc. The data that were submitted are summarized and recorded in Table 2. Included are the are averages of food chemistry values given in the Table 11 of NTF comments for various types of AMR product; FSIS AMR neckbone survey (1996) results using the ARS dry ash procedure; average AMI -AMR results for pork and beef samples; results reported by Beef Inc. in their comment; results from EXCEL corporation for hand deboned cut close to the bone for beef and pork; and mean results reported by HNS of raw, non-AMR product of various types. The MPR and iron to protein ratios are calculated as the ratio of moisture or iron to protein from the table entries.

For the NTF results, the number of samples analyzed for protein, moisture, fat, and cholesterol was 3 for all product types, while for calcium and iron there were 10 samples of turkey and various numbers less than 10 for the other products.

For the AMI results, there were 153 samples of beef and 109 samples of pork.

For the EXCEL, results there were 15 samples of beef and 14 samples of pork.

Not presented in the table are other sample results given in the appendix B of the NTF comments. There, for samples listed as A samples, calcium levels were about twice as high as those of samples listed as B samples that were presented in the NTF comment.

Summary results of 1996 FSIS neckbone survey.

Table 3 presents summary of results for selected variables by establishments. Mean values are reported for protein, fat, moisture protein ratio, calcium, cholesterol, iron and iron to protein ratio.

TABLE 1: COMPARISON OF ARS DRY ASH AND FSIS WET ACID DIGESTION RESULTS
UNITS MG/100G
AMR = PRODUCT FROM ADVANCEMENT RECOVERY SYSTEMS
HAND = HAND DEBONED PRODUCT

OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
1	AMR	2.36	5.08	2.15
2	AMR	3.19	5.9	1.85
3	AMR	2.46	7.03	2.86
4	AMR	1.83	4.13	2.26
5	AMR	2.69	4.13	1.54
6	AMR	2.81	5.15	1.83
7	AMR	2.49	4.8	1.93
8	AMR	1.79	5.18	2.89
9	AMR	2.23	5.59	2.51
10	AMR	2.41	5.97	2.48
11	AMR	7.91	8.32	1.05
12	AMR	4.88	7.02	1.44
13	AMR	2.39	5.56	2.33
14	AMR	2.94	5.23	1.78
15	AMR	2.57	4.99	1.94
16	AMR	2.64	5.08	1.92
17	AMR	2.72	4.97	1.83
18	AMR	2.81	4.88	1.74
19	AMR	2.82	5.09	1.8
20	AMR	2.04	5.26	2.58
21	AMR	3.59	5.36	1.49
22	AMR	3.56	5.19	1.46
23	AMR	2.9	6.17	2.13
24	AMR	3.03	5.43	1.79
25	AMR	3.52	3.53	1.4
26	AMR	3.51	5.61	1.6
27	AMR	3.26	5.33	1.63
28	AMR	3.32	5.03	1.52
29	AMR	2.68	4.76	1.78
30	AMR	3.17	5.42	1.71
31	AMR	3.9	6.05	1.55
32	AMR	2.31	5	2.16
33	AMR	2.7	6.43	2.38
34	AMR	1.51	4.93	3.26
35	AMR	2.36	5.37	2.28
36	AMR	2.26	5.07	2.24
37	AMR	1.79	5.26	2.94
38	AMR	1.7	4.44	2.61
39	AMR	2.42	4.37	1.81
40	AMR	1.7	4.89	2.88
41	AMR	2.3	6.2	2.7
42	AMR	2.51	6.31	2.51
43	AMR	2.52	5.61	2.23

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OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
44	AMR	2.66	6.17	2.32
45	AMR	3.05	4.72	1.55
46	AMR	3.21	6.11	1.9
47	AMR	2.39	6.1	2.55
48	AMR	2.2	4.99	2.27
49	AMR	1.78	6.11	3.43
50	AMR	2.2	5.85	2.66
51	AMR	2.42	5.91	2.44
52	AMR	2.55	6.38	2.5
53	AMR	3.87	6.78	1.75
54	AMR	1.78	4.86	2.73
55	AMR	1.79	6.74	3.77
56	AMR	2.27	5.95	2.62
57	AMR	4.11	6.43	1.56
58	AMR	2.96	6.19	2.09
59	AMR	2.31	4.99	2.16
60	AMR	2.37	4.72	1.99
61	AMR	2.29	4.67	2.04
62	AMR	1.94	5.42	2.79
63	AMR	1.52	5.43	3.57
64	AMR	2.07	5.62	2.71
65	AMR	3.03	5.63	1.86
66	AMR	2.05	7.47	3.64
67	AMR	2.36	6.58	2.79
68	AMR	3	5.3	1.77
69	AMR	2.89	4.85	1.68
70	AMR	3.21	4.36	1.36
71	AMR	2.84	5.44	1.92
72	AMR	2.69	5.89	2.19
73	AMR	2.95	6.09	2.06
74	AMR	3.34	6.33	1.9
75	AMR	3.95	5.91	1.5
76	AMR	4.44	7.52	1.69
77	AMR	3.45	5.37	1.56
78	AMR	3.73	5.47	1.47
79	AMR	3.69	5.94	1.61
80	AMR	2.75	4.89	1.78
81	AMR	2.51	5.69	2.27
82	AMR	2.62	5.65	2.16
83	AMR	2.69	5.93	2.2
84	AMR	2.36	5.07	2.15
85	AMR	1.97	4.42	2.24

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OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
86	AMR	2.02	5.4	2.67
87	AMR	2.25	5.91	2.63
88	AMR	3.63	8.95	2.47
89	AMR	3.85	6.98	1.81
90	AMR	4.08	7.13	1.75
91	AMR	2.57	5.7	2.22
92	AMR	3.03	8.19	2.7
93	AMR	1.88	3.26	1.73
94	AMR	2.64	6.52	2.47
95	AMR	2.54	7.27	2.86
96	AMR	3.86	7.01	1.82
97	AMR	3.1	6.39	2.06
98	AMR	3.77	5.71	1.51
99	AMR	3.02	6.8	2.25
100	AMR	2.35	5.16	2.2
101	AMR	2.58	4.86	1.88
102	AMR	2.29	5.02	2.19
103	AMR	2.96	3.87	1.31
104	AMR	3.21	5.91	1.84
105	AMR	1.88	5.93	3.15
106	AMR	2.04	5.48	2.69
107	AMR	2.4	4.14	1.73
108	AMR	2.36	5.11	2.17
109	AMR	3.1	4.99	1.61
110	AMR	3.42	5.83	1.7
111	AMR	2.34	4.86	2.08
112	AMR	3.89	4.91	1.26
113	AMR	2.96	6.05	2.04
114	AMR	3.5	6.43	1.84
115	AMR	3.37	5.38	1.6
116	AMR	1.97	4.96	2.52
117	AMR	3.15	5.6	1.78
118	AMR	3	6.15	2.05
119	AMR	3.24	5.96	1.84
120	AMR	2.72	5.68	2.09
121	AMR	3.54	6	1.69
122	AMR	3.7	6.55	1.77
123	AMR	2.63	4.83	1.84
124	AMR	3.12	5.95	1.91
125	AMR	4.14	8.21	1.98
126	AMR	1.78	4.37	2.46
127	AMR	1.96	5.27	2.69

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OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
128	AMR	1.91	3.98	2.08
129	AMR	2.22	5.84	2.63
130	AMR	2.85	5.35	1.88
131	AMR	2.35	6.13	2.61
132	AMR	2.64	7.67	2.11
133	AMR	3.19	7.08	2.22
134	AMR	2.27	6.56	2.89
135	AMR	2.96	5.16	1.74
136	AMR	2.57	6.16	2.4
137	AMR	2.25	6	2.67
138	AMR	2.14	6.37	2.98
139	AMR	2.39	6.61	2.77
140	AMR	2.81	6.66	2.37
141	AMR	5.3	6.34	1.2
142	AMR	5.13	6.98	1.36
143	AMR	4.36	5.13	1.18
144	Hand	1.06	2.26	2.13
145	Hand	1.1	2.64	2.4
146	Hand	1.09	2.36	2.17
147	Hand	1.06	2.46	2.32
148	Hand	1.34	2.43	1.81
149	Hand	1.4	2.7	1.93
150	Hand	1.78	3.29	1.85
151	Hand	1.56	2.6	1.67
152	Hand	1.82	2.74	1.5
153	Hand	1.78	2.88	1.62
154	Hand	1.9	2.88	1.51
155	Hand	1.79	2.84	1.58
156	Hand	1.43	2.48	1.74
157	Hand	1.56	2.62	1.68
158	Hand	1.65	2.72	1.65
159	Hand	1.48	2.5	1.69
160	Hand	1.37	2.56	1.87
161	Hand	1.6	2.62	1.64
162	Hand	1.18	2.47	2.09
163	Hand	1.26	2.58	2.05
164	Hand	1.69	1.67	0.99
165	Hand	1.53	2.45	1.6
166	Hand	1.21	2.14	1.77
167	Hand	1.74	3.04	1.75
168	Hand	1.7	3.82	2.25
169	Hand	1.07	1.94	1.81

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OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
170	Hand	1.51	2.37	1.57
171	Hand	1.01	3.01	2.98
172	Hand	1.25	2.47	1.98
173	Hand	1.2	4.01	3.34
174	Hand	1.14	2.54	2.23
175	Hand	1.41	3.22	2.28
176	Hand	1.77	4.14	2.34
177	Hand	1.64	3.44	2.1
178	Hand	1.14	2.98	2.61
179	Hand	1.58	3.66	2.31
180	Hand	1.62	2.31	1.43
181	Hand	1.19	3.23	2.71
182	Hand	1.1	3.4	3.09
183	Hand	1.19	3.35	2.82
184	Hand	1.22	3.03	2.48
185	Hand	1.6	4.55	2.84
186	Hand	1.44	2.92	2.03
187	Hand	1.46	4.93	3.38
188	Hand	1.4	4.33	3.09

Table 2: Mean values:

Type	Cal (mg/ I 00g)	Iron (mg/100g)	Choi. (mg/ I 00g)	%prot	%fat	%moist	MPR	iron/protein
NTF-Turk	33	1.41	79.20	13.1	21.68	64.4	4.92	0.108
NTF-chik	61	2.14	98.07	13.2	19.77	65.0	4.92	0.162
NTF pork	101	3.38	110.64	13.6	23.69	63.1	4.64	0.249
NTF beef	108	4.96	99.03	15.9	17.10	61.7	3.88	0.312
AMI beef'	107.4	5.59		15.03			0.00	0.372
AMI pork	101.5	2.84		14.77			0.00	0.192
Beef Product inc.[b] AMR	102	5.64	86.41	15.3	22.0	62.00	4.05	0.369
F'SIS-AMR beet', neck	106	5.76	114.83	16.35	20.01	63.26	3.87	0.356[c]
FSIS Hand deboned beef, neck	17	2.99	69.44	21.65	8.35	71.45	3.30	0.138
Beef, Product inc. [b] Hand	26	2.26	86.0	20.85	10.55	70.98	3.40	0.108
HNS G. l3cef extra lean	7	1.95	69.0	18.7	17.06	63.19	3.38	0.104
HNS G. Beef lean	8	1.77	75.0	17.69	20.67	60.18	3.40	0.100
HNS G. Beef regular	8	1.73	85.0	16.62	26.55	56.06	3.37	0.104
Excell Beef hand deboned close[c]	33	2.02		18.50	13.00	67.30	3.64	0.109
Excell Pork hand deboned close[c]	100	0.89		17.60	15.00	66.13	3.76	0.051
HNS-G. Pork	14	0.88	72.0	16.88	21.19	61.06	3.62	0.052
HNS- chik, dark, meat mid skin Broiler, fry-rs	11	0.98	75.0	16.69	18.34	65.42	3.92	0.059
Roasting, dark meat	9	1.15	72.0	18.74	3.61	75A8	4.03	0.061
stewing,	10	1.22	71.0	19.70	8.12	71.90	3.65	0.062

dark meat								
HNS- chik, light meat and skin Broiler, fry-rs	11	0.79	67.0	20.72	11.07	68.60	3.31	0.038
roasting, light meat	11	0.89	57.0	22.2	1.63	74.3	3.35	0.040
stewing, light meat	11	0.92	47.0	23.1	4.21	73.24	3.17	0.040
HNS-turk dark meat, skin	17	1.69	72.0	18.92	8.8	71.3	3.77	0.089
HNS-turk light meat, skin	13	1.21	72.0	21.64	7.36	69.83	3.23	0.056

[a] calculated by using iron protein ratio given for corresponding HNS raw product, for beef iron protein ratio =0. 104
[b] Comments of Jan. 7, 1997 attachment A of letter.
[C] Calculated as average of sample specific iron to protein ratios
[d] Comments of Sept. 30, 1998

Table 3: FSIS neckbone survey: Mean of Results for Selected Variables, by Establishment.
A = advanced meat recovery system prodcut,
H = hand deboned produt

Est. number	Type Debone	pressure PSI	protein (%)	fat (%)	Moist Protein Ratio(MPR)	calcium (%)	Cholesterol (mg/100g)	total iron mg/100g)	iron protein ratio
Average	A		16.35	20.03	3.893	0.106	114.83	5.716	0.353
Average	H	0	21.65	8.35	3.307	0.017	69.444	2.9	0.138
1[a]	A	2466	17.34	18.41	3.710	0.127	118.85	5.411	0.313
2	A	2793	16.28	19.47	3.909	0.120	105.96	6.421	0.395
3	A	3300	11.85	38.80	4.093	0.107	104.19	5.079	0.427
4	A	2912	17.05	18.42	3.755	0.075	96.11	5.243	0.308
5	A	3500	17.53	17.56	3.722	0.128	121.35	6.105	0.349
6[b]	A	5500	15.51	17.43	4.317	0.099	121.36	5.914	0.382
7	A	2000	17.34	16.30	3.836	0.084	138.37	5.698	0.329
8	H	0	21.44	9.85	3.270	0.024	74.19	3.179	0.148
9	H	0	21.85	6.86	3.343	0.011	64.70	2.794	0.128

[a] Establishment used a Protecon machine, while others used Hydrosep machines.
[b] Establishment did not perform desinewing operation.

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5	AMR	2.69	4.13	1.54
6	AMR	2.81	5.15	1.83
7	AMR	2.49	4.80	1.93
8	AMR	1.79	5.18	2.89
9	AMR	2.23	5.59	2.51
10	AMR	2.41	5.97	2.48
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26	AMR	3.51	5.61	1.60
27	AMR	3.26	5.33	1.63
28	AMR	3.32	5.03	1.52
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67	AMR	2.36	6.58	2.79
68	AMR	3.00	5.30	1.77
69	AMR	2.89	4.85	1.68
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72	AMR	2.69	5.89	2.19
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76	AMR	4.44	7.52	1.69
77	AMR	3.45	5.37	1.56
78	AMR	3.73	5.47	1.47
79	AMR	3.69	5.94	1.61
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109	AMR	3.10	4.99	1.61
110	AMR	3.42	5.83	1.70
111	AMR	2.34	4.86	2.08
112	AMR	3.89	4.91	1.26
113	AMR	2.96	6.05	2.04
114	AMR	3.50	6.43	1.84
115	AMR	3.37	5.38	1.60
116	AMR	1.97	4.96	2.52
117	AMR	3.15	5.60	1.78
118	AMR	3.00	6.15	2.05
119	AMR	3.24	5.96	1.84
120	AMR	2.72	5.68	2.09
121	AMR	3.54	6.00	1.69
122	AMR	3.70	6.55	1.77
123	AMR	2.63	4.83	1.84
124	AMR	3.12	5.95	1.91
125	AMR	4.14	8.21	1.98
126	AMR	1.78	4.37	2.46
127	AMR	1.96	5.27	2.69

TABLE 1: COMPARISON OF ARS DRY ASH AND FSIS WET ACID DIGESTION RESULTS
UNITS MG/100G
AMR = PRODUCT FROM ADVANCEMENT RECOVERY SYSTEMS
HAND = HAND DEBONED PRODUCT

OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
128	AMR	1.91	3.98	2.08
129	AMR	2.22	5.84	2.63
130	AMR	2.85	5.35	1.88
131	AMR	2.35	6.13	2.61
132	AMR	3.64	7.67	2.11
133	AMR	3.19	7.08	2.22
134	AMR	2.27	6.56	2.89
135	AMR	2.96	5.16	1.74
136	AMR	2.57	6.16	2.40
137	AMR	2.25	6.00	2.67
138	AMR	2.14	6.37	2.98
139	AMR	2.39	6.61	2.77
140	AMR	2.81	6.66	2.37
141	AMR	5.30	6.34	1.20
142	AMR	5.13	6.98	1.36
143	AMR	4.36	5.13	1.18
144	Hand	1.06	2.26	2.13
145	Hand	1.10	2.64	2.40
146	Hand	1.09	2.36	2.17
147	Hand	1.06	2.46	2.32
148	Hand	1.34	2.43	1.81
149	Hand	1.40	2.70	1.93
150	Hand	1.78	3.29	1.85
151	Hand	1.56	2.60	1.67
152	Hand	1.82	2.74	1.50
153	Hand	1.78	2.88	1.62
154	Hand	1.90	2.88	1.51
155	Hand	1.79	2.84	1.58
156	Hand	1.43	2.48	1.74
157	Hand	1.56	2.62	1.68
158	Hand	1.65	2.72	1.65
159	Hand	1.48	2.50	1.69
160	Hand	1.37	2.56	1.87
161	Hand	1.60	2.62	1.64
162	Hand	1.18	2.47	2.09
163	Hand	1.26	2.58	2.05
164	Hand	1.69	1.67	0.99
165	Hand	1.53	2.45	1.60
166	Hand	1.21	2.14	1.77
167	Hand	1.74	3.04	1.75
168	Hand	1.70	3.82	2.25
169	Hand	1.07	1.94	1.81

TABLE 1: COMPARISON OF ARS DRY ASH AND FSIS WET ACID DIGESTION RESULTS
UNITS MG/100G
AMR = PRODUCT FROM ADVANCEMENT RECOVERY SYSTEMS
HAND = HAND DEBONED PRODUCT

OBS	Type of Product	FSIS Wet Acid	ARS Dry Ash	Ratio Dry Ash to Wet Acid
170	Hand	1.51	2.37	1.57
171	Hand	1.01	3.01	2.98
172	Hand	1.25	2.47	1.98
173	Hand	1.20	4.01	3.34
174	Hand	1.14	2.54	2.23
175	Hand	1.41	3.22	2.28
176	Hand	1.77	4.14	2.34
177	Hand	1.64	3.44	2.10
178	Hand	1.14	2.98	2.61
179	Hand	1.58	3.66	2.31
180	Hand	1.62	2.31	1.43
181	Hand	1.19	3.23	2.71
182	Hand	1.10	3.40	3.09
183	Hand	1.19	3.35	2.82
184	Hand	1.22	3.03	2.48
185	Hand	1.60	4.55	2.84
186	Hand	1.44	2.92	2.03
187	Hand	1.46	4.93	3.38
188	Hand	1.40	4.33	3.09