amc technical brief

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Nitrogen factors

Organoleptically, nutritionally and economically, the protein content of food is of paramount importance. The quantitative assessment of protein content, based on the determination of nitrogen concentration on a fat-free basis, permits the detection of inadvertent or fraudulent dilution of foods by non-protein components. The constant of proportionality relating protein content to determined nitrogen content is called the 'nitrogen factor', and using its correct numerical value is critical in the interpretation of analytical data. The AMC has been involved in the determination and recommendation of nitrogen factors since the 1950s.

Because of changes in butchering practice and the breeds of animal, and the introduction of stricter legal requirements on the composition of foods, doubts about the continuing relevance of nitrogen factors used in the 1980s were general by 1990. Accordingly the Nitrogen Factors Subcommittee of the AMC was reconvened to determine whether or not the factors required amendment. A number of controlled investigations have been organised, involving strict selection of the initial raw material, the application of rigid protocols for the sampling and preparation of the material and for its distribution to a group of accredited laboratories for analysis by British Standard methods. To date, reports on pork[1], beef[2], mutton[3], lamb[4], chicken[5] and scampi[6] have been published. The results are summarised below.

Pork[1]
A nitrogen factor of 3.50 is recommended, when applied to the entire comminuted raw meat (including intermuscular fat) from the whole side of pork from 70 kg carcasses. This is the best factor for general use in the analysis of pork products including cured pork. The definition of the national average processing pig, in relation to carcass weight and fat thickness, should be assessed periodically to ascertain whether the nitrogen factor requires amendment. When information on specific individual joints is available, the factors in Table 1 are more appropriate.

Beef[2]
A nitrogen factor of 3.65 (for the lean with intermuscular fat) is recommended when applied to beef generally. For clean beef and cull cow beef, factors of 3.65 and 3.70 respectively should be used. When carcass weight and EC fatness and conformation class are known, changes in the nitrogen factors can be calculated. When information on individual joints of clean beef and cull cow beef is available, the factors in Tables 2 and 3, respectively, should be used.

Sheepmeat (mutton and lamb)[3,4]
A nitrogen factor of 3.50 (for the lean with intermuscular fat) is recommended for mutton and lamb generally. When information on forequarters, hindquarters or individual joints is available, the nitrogen factors in Table 4 should be used.

Chicken[5]
Nitrogen factors of 3.50 for the skin-on carcass and 3.55 for the skin-off carcass are recommended when the cut is not specified. When the cut is known the nitrogen factors in Table 5 should be used. When the type of chicken is not specified, the value for broilers is recommended, since 90% of the chicken used in manufactured foods is derived from broilers.

Scampi (*Nephros norvegicus*)[6]
Based on the relative contributions of hard-, thin-, and soft-shelled individuals studied, a nitrogen factor of 2.90 is recommended for scampi as caught from the sea. This value is diminished by subsequent processing (*e.g.*, storage in ice, mode of peeling and cleaning, and drainage thereafter).

References
AMC, Analyst, 1991, 116, 761-766.
AMC, Analyst, 1993, 118, 1217-1226.
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AMC, Analyst, 1996, 121, 889-896.
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Table 1: Nitrogen factors for pork joints

Sample	Lean with intermuscular fat	Lean with intermuscular and subcutaneous fats	Lean with intermuscular and subcutaneous fats and rind
Leg (ham)	3.49	3.50	3.63
Neck (collar)	3.38	3.42	3.54
Hand	3.42	3.44	3.60
Loin (back)	3.66	3.66	3.90
Belly (streak)	3.50	3.51	3.74
Middle cuts (Loin and belly)	3.58	3.50	3.82
Whole side	3.50	3.52	3.70

Table 2: Nitrogen factors for clean beef joints

Sample	Lean	Lean with intermuscular fat	Lean with intermuscular and subcutaneous fats
Brisket	3.57	3.61	3.60
Jacob's ladder	3.64	3.64	3.65
Fore rib	3.66	3.69	3.70
Chuck	3.57	3.57	3.58
Thin flank	3.68	3.73	3.73
Shin and leg	3.71	3.72	3.80
Clod and sticking	3.59	3.59	3.61
Topside	3.71	3.71	3.73
Loin, rump and fillet	3.66	3.68	3.70
Thick flank and silverside	3.64	3.64	3.66
Side	3.64	3.65	3.66
Pistola	3.67	3.68	3.70
Forequarter	3.61	3.62	3.63

Table 3: Nitrogen factors for cull cow beef joints

Sample	Lean	Lean with intermuscular fat	Lean with intermuscular and subcutaneous fats
Brisket	3.71	3.74	3.76
Jacob's ladder	3.76	3.78	3.80
Fore rib	3.77	3.80	3.80
Chuck	3.64	3.65	3.66
Thin flank	3.73	3.77	3.80
Shin and leg	3.81	3.82	3.90
Clod and sticking	3.68	3.70	3.72
Topside	3.66	3.66	3.70
Loin, rump and fillet	3.66	3.67	3.73
Thick flank and silverside	3.62	3.61	3.66
Side	3.68	3.70	3.73
Pistola	3.66	3.67	3.72
Forequarter	3.70	3.72	3.74

Table 4: Nitrogen factors for mutton and lamb quarters and joints

Sample	Lean and intermuscular fat	Lean and intermuscular and subcutaneous fats
Mutton forequarter	3.48	3.50
Mutton hindquarter	3.50	3.52
Mutton side	3.49	3.52
Lamb forequarter	3.50	3.53
Lamb hindquarter	3.49	3.53
Lamb side	3.49	3.53
Lamb leg and chump	3.45	3.50
Lamb loin & best end neck	3.61	3.66
Lamb scrag, shoulder, midneck & breast	3.48	3.51

Table 5: Nitrogen factors for chicken

Joint	Lean with intermuscular fat		Lean with intermuscular fat and skin	
	Broilers	Hens	Broilers	Hens
Breast	3.85	3.90	3.80	3.90
Leg	3.25	3.50	3.25	3.50
Thigh	3.35	3.45	3.35	3.50
Other meat	3.35	3.45	3.30	3.50
Dark meat	3.30	3.45	3.30	3.50
Carcass	3.55	3.65	3.50	3.60