

## Assessment of fibre in the diet - Effective NDF

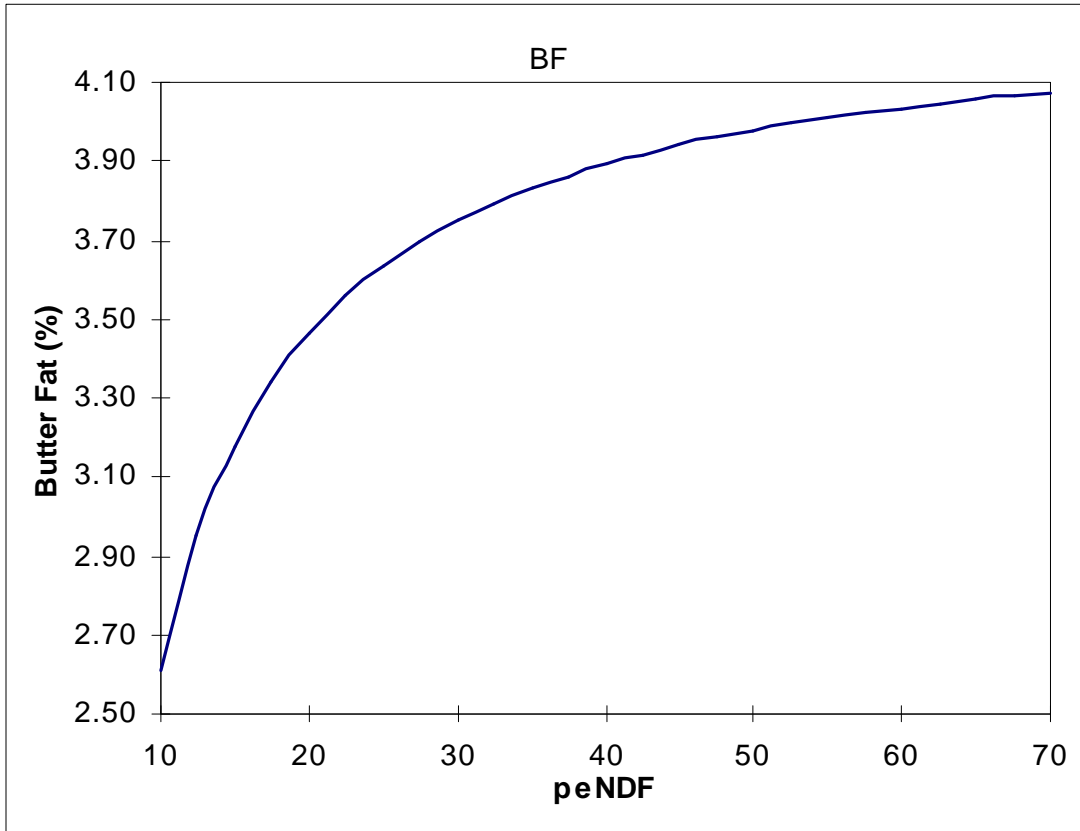
### A T Chamberlain - [www.rumnut.com](http://www.rumnut.com) - 25 September 2001

NDF is a simple chemical measurement of fiber and although it is a good estimate of rumen available fiber it takes no account of the physical effectiveness of the fiber in forming the fiber mat in the rumen, stimulating chewing, cudging or saliva flow. Mertens (1997) proposes a derived measurement called physically effective NDF (peNDF) based on the NDF content of the feed and the physical effectiveness. The physical effectiveness factors (pef) are shown below. Some are taken from the original paper, UK type feeds have been set at corresponding values. Long hay is the reference point with a value of 1.0 dropping to 0.80 for finely chopped maize silage and down to 0.30 for pelleted compound feeds.

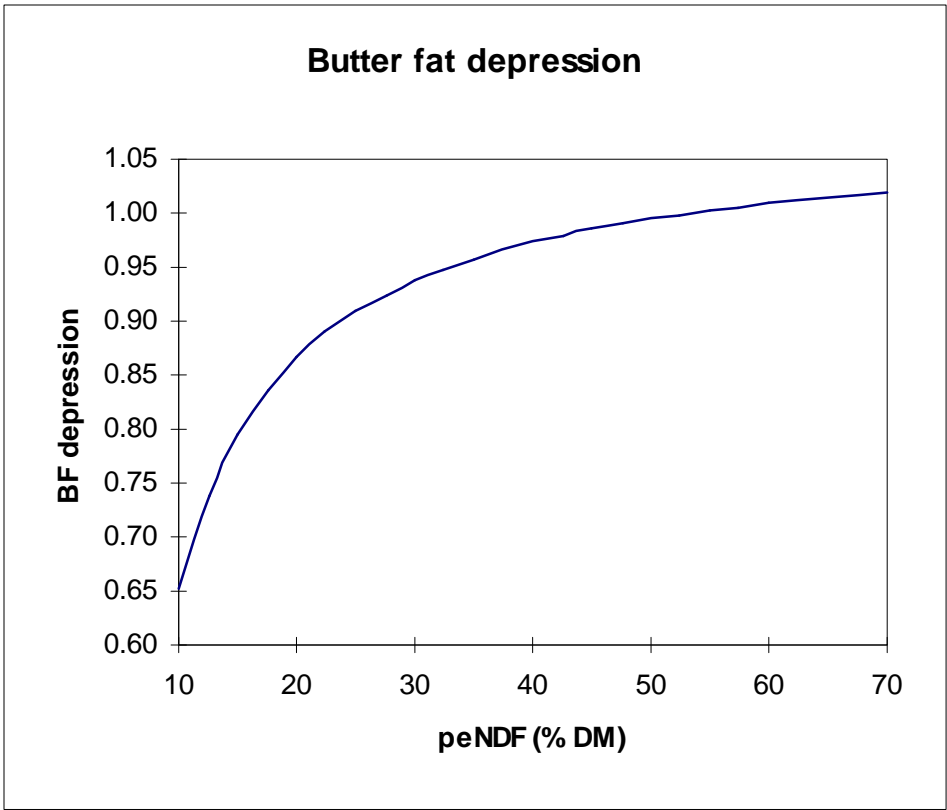
Feed	Physical form	Physical effectiveness factors (pef)
Grass hay	Long	1.00
	Coarsely chopped	0.95
Straw	Unchopped	1.00
	Chopped (10-15cm)	0.95
	Chopped (< 10cm)	0.90
Grass silage	Big bale - mature	0.95
	Big bale - high quality	0.90
	Medium chopped	0.85
	Finely chopped	0.80
Maize silage	Medium chop	0.85
	Finely chopped	0.80
Fresh grass	With seed heads	0.95
	Medium quality	0.90
	High quality	0.80
Cereals	Rolled	0.60
	Medium ground	0.40
Protein byproduct meals		0.40
Sugar beet pulp		0.70
Brewers grains		0.70
Complex mixtures	Ground	0.40
	Pelleted	0.30

A compound feed containing 180g NDF / kg DM would have a peNDF of only 54 g peNDF /kg DM whereas long chopped straw containing 800g NDF / kg DM would have a peNDF of 720g peNDF /kg NDF.

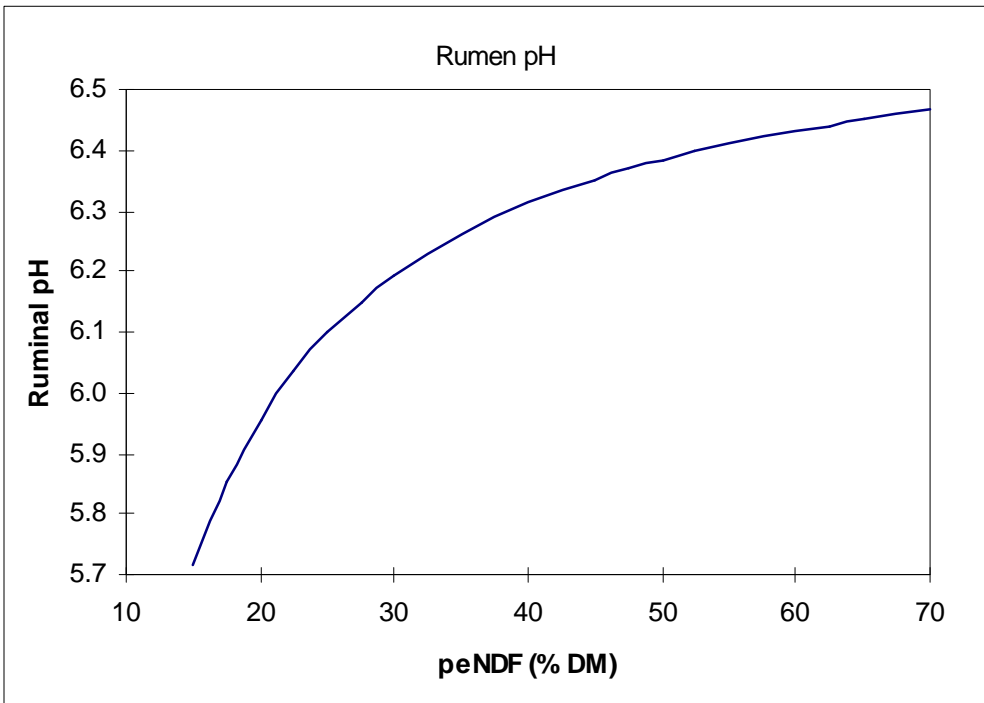
Mertens 1997 (JDS 80 p1463-1481) derived a relationship (for American Holstein cows) between peNDF and butter fat content of the milk.



These figures are for American Holstein cows in American situations where BF is always lower than ours. In the UK we have a different genetic base and types of diets and so cows will respond a bit differently - I suspect they will have a higher BF for any given peNDF. To remove this effect lets assume the curve flattens out at 4.0 BF for an American cow on an American diet and then convert the other figures to a 'BF depression value' as a proportion of 4.0.



The reasons for this butter fat depression can be seen in the relationship derived between peNDF and rumen pH. Given that optimal pH is about 6.5 and at lower pH's rumen microbe function alters it can be seen why peNDF affects butter fat.



I will modify RUMNUT (ver 4.0b and later) so that the cellulose field is changed to peNDF and contains the peNDF Figures. Users will have to calculate their own peNDF figures from the NDF and the above table. These figures will then be used to calculate the peNDF of the ration, the butter fat depression and the rumen pH value and depression from a value of 6.5. Hopefully these figures will allow many of the current butter fat depression problems to be identified correctly and actions taken to correct the problems.

### **Abstracts of source references**

Mertens, D. R. (1997). "Creating a System for Meeting the Fiber Requirements of Dairy Cows." J Dairy Sci **80**: 1463-1481.

Current NRC recommendations for dairy cattle provide limited guidance to nutritionists for meeting the fiber and carbohydrate needs of lactating cows. The NRC provides only minimum recommendations for fiber and no accommodation for factors such as physical effectiveness of fiber, interactions with nonfibrous carbohydrates, or animal attributes, which can affect the optimality of dairy rations. To be an improvement, any new system for meeting the fiber requirements of dairy cows must be based on 1) feed characteristics that can be defined and preferably be determined quantitatively using routine laboratory methods and 2) animal requirements that correspond to critical feed characteristics and vary with feeding situation, ration composition, and attributes of the animal. Published data were used to develop coefficients for defining the physical effectiveness or roughage value of feeds and the fiber requirements of dairy cows. Information in this paper is intended to provide practical guidelines for improving current fiber recommendations and to serve as an idealized framework for future research on meeting the fiber requirements of dairy cows. The system is based on NDF as the measure of total chemical fiber in feeds. Adjustments for the effectiveness of NDF in maintaining milk fat production and optimizing ruminal fermentation are based on the particle size and inherent characteristics of NDF that affect chewing activity, ruminal pH, and milk fat production.

Armentano, L. and A. M. Pereir (1997). "Measuring the Effectiveness of Fiber by Animal Response Trials." J Dairy Sci **80**: 1416-1425.

Chemical analysis of neutral detergent fiber (NDF) provides a useful description of forages and other feeds. However, use of NDF as the sole measure of the fiber contribution of a feed has proved problematic for two classes of feeds: forages processed into differing physical forms and high fiber by-products. By-products and physically fine forages contribute to the fiber value of dairy rations, but contribute less than long forages do. Therefore, some discount factors must be assigned to these feeds if fiber requirements are to be used in balancing the carbohydrate portion of dairy diets. The effectiveness factors applied to NDF from these feeds provide an improved measure of fiber value. The assumptions and trial designs used to measure the effectiveness of NDF based on any single animal response variable are discussed, and improved approaches are suggested. The use of different response variables to measure physical and overall fiber effectiveness is discussed. Measured effectiveness of a high fiber feed differs when estimated by chewing, by the ratio of acetate to propionate, or by milk fat concentration. In all cases, inclusion of negative control treatments is necessary to measure the effect of removing fiber without introducing a substitute fiber source.