Nutritional evaluation of some commercial wheat varieties grown in Pakistan

M. AKMAL KHAN, IFTIKHAR A. RANA & IHSAN ULLAH
Food Technology Research Laboratories, National Agricultural Research Centre, Islamabad, Pakistan

Received 18 April 1986; in revised form 2 February 1987

Key words: wheat varieties, chemical composition, gross energy, amino acids, nitrogen balance, true protein digestibility, biological value, net protein utilisation

Abstract. The nutritive value of some commercial wheat varieties grown in Pakistan was measured chemically, including amino acid analysis, and biologically in N-balance experiments with growing rats. The protein content ranged from 13.2% in Punjab-83 to 16% in Barani-83. Lysine per 100g protein varied between 2.46 and 2.75%. The available carbohydrate ranged from 67.3 to 74.7%. Iron content was highest in Sonalika while the concentration of zinc and manganese was highest in Sarhad-82. The protein digestibility (TD), biological value (BV) and net protein utilisation (NPU) varied between 92-95%, 56-68% and 53-65% respectively. Level of wheat protein was negatively correlated with available carbohydrate ($r = -0.93$), lysine per unit protein ($r = -0.67$) and BV($r = -0.76$). The lysine content (g/16gN) of commercial wheat varieties showed a positive correlation ($r = +0.95$) with the BV. The protein quality was lowered in varieties having higher content of protein.

Introduction

Cereal grains are the dietary mainstay of mankind and provide three quarters of man’s energy needs and more than one half of his protein needs. Wheat is the main staple food in Pakistani diets and constitutes 83 percent of the total cereals intake. The protein content and lysine per unit protein of some Pakistani improved varieties of wheat ranging from 12.3 to 16.7% and 2.46 to 2.96% respectively have been reported [11]. Wheat protein has an imbalance of essential amino acids for its complete biological utilization. According to Khan [7], the order of limiting amino acids in wheat protein is lysine, threonine and valine. Mixed human diets, breakfast cereals and baby foods based on wheat have been shown to be deficient in lysine [8, 10].

Known genetic variability for lysine is substantially less in wheat than other cereals. According to Johnson et al. [5] the genetic variability for lysine in wheat is no more than 0.5 of a percentage point when lysine is expressed
as percent of protein. The amount of lysine in wheat is influenced by the level of protein [14] and the relationship is curvilinear [6].

The challenge to plant breeders is to develop cereal grain varieties that are both more productive and more nutritious. Consequently, any addition in protein quantity and/or quality will result in improved nutritional status of the population. The present paper deals with the nutritive value of some commercial wheat varieties evolved in Pakistan.

Materials and methods

Eight commercial wheat varieties grown in different parts of Pakistan were collected from the wheat programme of the National Agricultural Research Centre, Islamabad, Pakistan. All the varieties were ground to whole flour. The chemical composition was determined according to AOAC methods [12]. Available carbohydrate was estimated by using the method of Watson et al. [15]. The gross energy value was calculated by multiplying protein, fat and carbohydrate contents with factors of 4, 9 and 4 Kcal/gm, respectively. The amino acid analyses were carried out as described by Khan and Eggum [11]. Trace elements were analysed by using a Perkin-Elmer model 4000 atomic absorption spectrophotometer. All the assays were performed in duplicate. The biological utilisation of wheat protein was determined in N-balance experiments with growing rats [3].

Results

The chemical composition of commercial wheat varieties is shown in Table 1. The protein content (N x 5.7) was highest in Barani-83 (16.0%) and lowest in Punjab-83 (13.2%). The fat content appeared to lie between 2.6 and 3.0% while the available carbohydrate ranged from 67.3 to 74.7%. The fibre content varied from 2.2 to 2.9% while the ash content was almost uniform in all varieties. The concentration of calcium varied considerably with the highest value of 40.0 in Punjab-83 and the lowest of 11.0 mg per 100 g in Lyp-73. The phosphorus content ranged from 284.0 to 336.0 mg per 100 g while the iron content was highest (4.8 mg per 100 g) in Sonalika and lowest (2.9 mg per 100 g) in Faisalabad-83. The concentration of zinc and manganese varied from 2.5-4.1 and 5.0–6.6 mg per 100 g respectively.

The protein concentration of wheat varieties were negatively correlated with the available carbohydrate. The relationship is given in the following regression equation.