Sugar Beet by Product as a Potential Source of Dietary Fibers

MUHAMMAD RAUF KHAN AND MUHAMMAD YAQOOB
P.C.S.I.R. Laboratories,
Jamrud Road, Peshawar, Pakistan

(Received 18th November, 1995, revised 26th December, 1996)

Summary: Chemical composition and dietary fiber content of the sugar beet by product was determined. The product contained Neutral detergent fiber (NDF) 74% as cell wall constituents, non cell wall matter 26%, Neutral detergent fiber ash (NDF ash) 1.2%, Acid detergent fiber (ADF) 18%, cellulose 18%, Hemicellulose 31%, Pectin 22% and Lignin 3%. The chemical composition revealed carbohydrate 76.7%, water 10% sugar 3.8%, mineral substance 3.6%, Fat 0.3%, protein 9.4% and pH 4.6 ± 0.5. The product can hold water 3-4 times its own weight.

Introduction

Dietary fiber is an important food component that consists of plant materials which is resistant to hydrolysis by the endogenous enzymes of the mammalian digestive tract. Interest in fiber as an important dietary constituent was stimulated by epidemiological studies which linked the lack of fiber in the diet to chronic disorders such as constipation, diverticulitis, cancer of the large bowl as well as risk of obesity, cardiovascular disease and diabetes prevalent in western and developed countries [1-4]. In recent decades food fiber has attracted increasing attention both in nutritional studies and in other kinds of medical research [5]. People in general have become aware of the importance of fiber for our overall well being. More and more industrialized countries are recommending that the intake of food fiber be almost doubled which implies an increase to 30-40 grams daily per person [6-8].

Sugar beet is a major sugar producing crop of N.W.F.P. During crushing season, if not disposed quickly, the waste soon deteriorates, causing nauseating odour. This by-product (waste) could be transformed into profitable materials such as dietary fibers. Thus, the objective of this study was to produce valuable dietary fiber from sugar beet by product.

Results and Discussion

The chemical composition of the prepared fiber on dry weight basis is given in Table-1. It contained moisture 10% and carbohydrate 76.7%, total sugar 3.8%, mineral substances 3.6%, Fat 0.3% and protein 9.4% (Table 1). The pH was 4.6 ± 0.5. The dietary fiber pattern of the product on dry weight basis is presented. It contained NDF 74%, Non cell wall matter 26%, NDF ash 1.2%, cellulose 18%, Hemicellulose 53%, Pectin 22%. Lignin 3% and ADF 21% (Table-2). The most abundant components of dietary fibers are found in or are associated with the cell walls. These include cellulose, hemicellulose, pectins and lignin. Cellulose, hemicellulose and pectin which are polysaccharides, while lignin is non polysacchride. Pectin is reported to lower blood glucose and cholesterol [9,10]. Lignin is considered as effective bile acid absorbent. Cellulose increase the fecal wet weight and bulking action [11]. Sugar beet by product had water-holding capacity 3-4 times its own weight.

Table-1: Chemical Composition of Sugar beet by product.

S.No.	Composition	Per 100 gm
1.	Carbohydrate	76.7
2.	Water	10.0
3.	Sugar	3.8
4.	Mineral substances	3.6
5.	Fat	0.3
6.	Protein	9.4
7.	pH	4.6 ± 0.5

Results are mean values of 3 determinations.

The prepared fibers were sealed in the polyethylene bags and kept at ambient temperature for six months for shelf life studies. The samples were taken random after 30 days for physico chemical analysis. It retained its light colour and bland flavour during shelf life studies.

Table-2: Dietary fiber pattern of sugar beet by product

S.No.	Composition	Per 100 gm
1.	Neutral detergent Fiber (cell wall constituents)	74
2.	Non cellwall matter	26
3.	Neutral detergent fiber ash	1.2
4.	Cellulose	18
5.	Hemicellulose	53
6.	Pectin	22
7.	Lignin	3
8.	Acid detergent fiber	21

Results are mean values of 3 determinations.

The product was also organoleptically evaluated. The product has low lignin content and high pectin content, and has a higher water absorption capacity. It does not contain gluten or phytate and is more palatable than some other forms of dietary fiber. It could be used in bakery products, gravies, sauces, dressings, cereals extruded snacks, pasta, soups, batters and breadings and drinks.

It is clear from the aforesaid that sugar beet by product is a good source of dietary fibers and could be transformed into profitable food products.

Experimental

Preparation of sample

The sugar beet refuse (by product) was procured from Khazana sugar Mills, Peshawar. Immediately at arrival to the laboratory it was carefully washed in warm water and pressed to remove water. This process was repeated again untill sugar free pulp was obtained. This pressed pulp was dried in the Mitchael dehydrator [11].

Chemical analysis

The moisture was determined by drying the sample to constant weight in an oven at 105°C. The ash was determined by incineration of known weight of the sample in a furnace at 700°C. The lipid was determined by exhaustively extracting a known weight of the sample with diethyl ether (boiling point 35-40°C), using soxhlet apparatus. Protein (Nx6.25) was estimated by macrokjeldahl method [12]. pH was measured by the digital pH meter. The total carbohydrate was calculated by the indirect method. The dietary fiber composition was determined by the neutral detergent and acid detergent methods [13-15].

References

1. L.U. Thompson, *Diet Fiber Health Dis.*, 305 (1995).
2. D.R. Satchell, Kenneth, *Diet Fiber Health Dis.*, 294 (1995).
3. K. Yamashita, Y. Okuda, *Nippon Naika Gakkai, Zasshi,* **84**(1), 138 (1995).
4. S. Kitamura, *Saishin Igaku,* **50**(Suppl 595), 657 (1995).
5. V.E. Burley, E.B. John, *Diet Fiber Health Dis.*, 243 (1995).
6. D.A.T. Southgate, *Bioavailability,* **93**, Pt. 1, 128 (1993).
7. S. Kilkunaga, H. Ishii, S. Imada, M. Takahashi, *Nippon Kasei Gak Kaishi,* **46**(1), 3 (1995).
8. T.Gordon, Dennis, Stoops Dan, Ratliff, Vicki, *Diet Fiber Health Dis.*, 267 (1995).
9. Kritcheusky David, *Diet Fiber Health Dis.*, 353 (1995).
10. Truswell, A Stewart, *Opin. Lipidol,* **6**(1) 14 (1995).
11. Wan Liangcai, Yan, Shufen, xu, Dezhen, Han, Ying, Yng, *Yu Fajiao Gongye,* (3), 10 (1994).
12. Official methodes of analysis of the Association of Official analytical chemists, *A.O.A.C* (1985).
13. P.J. Vonsoest and R.H. Win, Journal of the *A.O.A.C,* **50**(1), 50 (1977).
14. P.J. Vonsoest and R.H. Win, *Journal of the A.O.A.C,* **46**(5), 829 (1963).
15. R.M. Faulks, A. Boenke, *Comm, EUR. Communities, (Rep)EUR, EUR* 15728, 141 (1994).