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Carrot and Citrus Juice Waste as Potential Source of Dietary Fiber

MUHAMMAD RAUF KHAN AND N.A. SUFI

PCSIR Laboratories, Jamrud Road, P.O. Peshawar University, Peshawar-25120, Pakistan

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There is a growing community awareness of the importance of an adequate intake of dietary fibers. There is a potential for many fruits, vegetables and cereal residues as dietary supplements and in food manufacture. Carrot and citrus processing by- products were used-due to their chemical composition and fiber content. The dejuiced pulps and peels were analysed for neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose, cellulose, lignin and NDF ash content. Carrot pulp contained no hemicellulose. Variation were noted in the chemical composition and dietary fiber pattern of carrot and citrus pulp and peel. This study was carried out to obtain fundamental data with respect to development of new uses for carrot and citrus by-products.

Dr. Dennis Barkitt and his colleagues drew attention to the potential health of dietary plant fiber [1-3]. Trowell defined fiber as any substance of plant origin which resists digestion by enzymes of human gastro-intestinal tract [3]. In British, USA and Australia consumption of dietary fibers has remained stable at about 20g/day [4-6]. Yashida and Ueda [7] conducted experiments on citrus by-products. Robertson [8] investigated Dietary fiber content in carrots. Schweizer and Wiirsch [9] analyzed dietary fibers of different fruits and vegetables. Kirby *et al.* [10] found that dietary fiber of some cereals lower cholesterol in humans. Story [11] described medical aspects of dietary fibers. The carrot and sour orange pulp is treated as waste. The pulp soon ferments giving off an unpleasant odour and therefore, has to be disposed off quickly. This study was initiated to determine whether carrot and citrus by-products could be transformed into profitable materials such as dietary fiber [12-14].

Locally grown red carrots were used for juice production. The carrot pulp was obtained from a juice producer at Qissa Khawani, Peshawar. The citrus peel and pulp was sampled from pilot plant at PCSIR, Peshawar. The carrot and sour orange pulps were washed with warm water (25-30°c) and squeezed. The process was continued for 10-15 minutes to leach out as much sugar and soluble solids as possible. It was dried in the Mitchel dehydrator at 50°C and then ground to 60 mesh size of fine powder.

Moisture, crude protein, crude fat, crude fiber, and ash contents were determined by the AOAC methods [15]. The percentage of nitrogen free extract (NFE) was estimated by substracting the percentage of other proximate composition from 100. The NDF, ADF, hemicellulose, cellulose and ADF lignin were determined by the neutral detergent fiber method and acid detergent methods [16,17].

The chemical composition of carrot and sour orange juice by- product is given in Table 1. The carrot pulp contained crude fat 0.6%, crude protein 7.6%, crude fiber 17.9%, ash 5% and NFE 68.9%. The sour orange pulp, sour orange juice refuse and albedo have been found to contain crude fat 1.6 to 1.7%, crude protein 8.0 to 5.8%, crude fiber 18.7 to 31.4%, ash 2.8 to 3.5% and NFE 68.9 to 57.5% respectively. Highest NFE 70.2% was determined in sour orange juice refuse while high crude fiber 31.4% was shown by sour orange albedo. The carrot pulp also contained high values of NFE 68.9% and crude fiber 17.9%. The major components NFE and crude fiber showed highest values. It was noted that crude protein and crude fat which are less important for dietary fibers, amounted to low values. The dietary fiber composition of carrot pulp and sour orange juice by-products is shown in Table 2. NDF values range from 31.4% in carrot juice refuse to 50% in sour orange albedo. ADF values range from 32.5% of carrot pulp to 42% in sour orange albedo, while ADF lignin 0.8% in carrot pulp to 6% in sour orange albedo. Carrot pulp contained no hemicellulose whereas in sour orange juice wastes hemicellulose range from 1.3 - 8.2% (Table 2). Cellulose contents were determined 32% in carrot

TABLE 1. CHEMICAL COMPOSITION OF CARROT AND SOUR ORANGE PULPS.

Sample	Moisture (%)	Crude fat (%)	Crude protein (%)	Crude fibre (%)	Ash (%)	NFE (%)
Carrot Pulp.	10.8	0.6	7.6	17.9	5.0	68.9
Sour Orange Pulp.	6.3	1.6	8.0	18.7	2.8	68.9
Sour orange Juice refuse	9.3	1.5	5.7	18.7	3.8	70.2
Sour Orange albedo.	6.0	1.7	5.8	31.4	3.5	57.5

Results are mean values of three determinations.

TABLE 2. DIETARY FIBRE COMPOSITION OF CARROT AND SOUR ORANGE PULPS

Sample	NDF cellwall constitu-ents. (%)	Non-Cell-wall con-stituents (%)	NDF Ash (%)	ADF (%)	Hemice-llulose NDF-ADF (%)	Cellu-lose ADF -ADF Lignin (%)	ADF-Lignin (%)
Carrot Pulp.	31.4	69	1	32.5	-	32	0.8
Sour orange pulp.	32.7	67	1	31.4	1.3	28	3
Sour orange juice refuse.	32.8	67	1	37	-	32	5
Sour orange elbedo.	50	50	0.7	42	8.2	37	6

Results are mean values of three determinations.

pulp and 28 - 37% in sour orange by-product. Yashida and Ueda [7] conducted experiments on citrus fruit variety Satsumaman-drain. Robertson [8] investigated dietary fiber content in carrots and a similar pattern was noted. From these studies it is concluded that carrot and sour orange by-products are potential sources of dietary fiber and could be transformed into profitable food products.

Key words: Carrot by-product, Citrus by-product, Dietary fibers, Chemical composition.

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