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Short Communication

Effect of Sand Roasting on the Fatty Acid Composition and Physicochemical Characteristics of Oil Extracted from *Arachis hypogea*

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Absctract. The fixed oil from the seeds of two varieties of *Arachis hypogea* was characterized and studied for its fatty acid composition by gas chromatography (GC). The effects of sand roasting on the physicochemical properties and the fatty acid composition were studied. The comparison of the oils before and after sand roasting showed that the oil extracted from the seeds before roasting contained palmitic acid (8.2 - 8.82%), stearic acid (3.7 - 3.9%), oleic acid (59.1 - 59.87%), linoleic acid (22.7 - 22.9%), linolenic acid (1.3 - 1.84%) and arachidic acid (3.6 - 3.7%). The oil extracted from the seed samples that were sand roasted had altered fatty acid composition and physicochemical constants. The percentage of stearic acid and linoleic acid was reduced after sand roasting, while there was increase in concentration of oleic acid. The peroxide and acid values increased while the iodine and saponification values showed decreasing trend. However, the changes observed were not to the extent of showing any adverse effect on the nutritional value of the oil extracted after sand roasting of the seeds of *Arachis hypogea.*

Keywords: *Arachis hypogea*, leguminosae, physicochemical properties, fatty acid composition, gas chromatography (GC)

Arachis hypogea (peanut) belongs to the plant family Leguminosae. It is the second largest oil seed crop after rape/mustard seeds in the Pakistan (Din *et al.,* 1999). The nut is normally composed of 25-35% shell and 65-70% kernel that in turn contains 45-55% oil and 25-30% protein. Peanut oil is used in cooking and in the preparation of shortening in pastry, margarines, mayonnaise, in salad dressing. The meal is used as food and also for feed purposes (Swern, 1979; Eckey, 1954; Thrope and Whitely *et al.,* 1947). It has 50-80 % oleic acid, therefore, affects HDL and LDL levels positively, reduces platelet stickness, increase circulation, reduces blood pressure, slows down cholesterol production, prevents inflammation, reduces joint tenderness, stimulates the immune system and assists the balancing of hormones (Curb *et al.,* 1954).

The present work was conducted to investigate the changes, if any, produced in peanut oil when heated in sand. Oil extracted from raw seeds and sand roasted seeds of two locally cultivated varieties of *Arachis hypogea*, was analyzed for comparative studies. The conventional method of roasting (sand roasting) and specific oil extraction techniques were used. The seeds of two varieties of *Arachis hypogea* Hanoi and Tillagang, were procured from two different areas of Hanoi and Tillagang. The seeds were divided into two-portions. One portion was kept in original form while the other portion was roasted in sand. Both portion raw and sand roasted were dried separately in an oven at 105 °C and crushed into fine powder. The lipids were extracted both from raw and roasted seeds of two varieties (Hanoi and Tillagang), according to method reported earlier (Akhter *et al.,* 2006; Folch *et al.,* 1957).

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The fatty acids of raw and sand roasted peanuts were treated with boron triflouride - methanol (Morrison and Smith, 1964) for the formation of methyl ester. The esters were extracted with hexane and stored at low temperature, analyzed on Shimadzu GC-4A gas chromatograph (Akhter *et al.,* 2006). The percentage yield of extracted oil showed a little bit decrease after sand roasting, which was insignificant in Hanoi but 1.92% decrease was observed in the Tillagang variety (Table 1).

The chemical characteristics of oil from raw and roasted seeds of both varieties are shown in Table 2. Saponification value, iodine value, ester value, and free fatty acid were determined according to British standard of specification and procedure (BSS 684, 1958). Refractive index was determined with Abbe's refrectometer. Iodine value of two raw varieties was 95.68 (Hanoi) and 101.36 (Tillagang) that were decreased to 87.96 in Hanoi and 89.42 in Tillagang, respectively. The decrease in iodine value indicated a decrease in the unsaturation after the sand roasting, which was also confirmed by the GC analysis.

The contents of unsaturated and polyenoic fatty acids were decreased with greater variations in the oils and the decrease was more evident after high heat treatment, which may caused bad affects on nutritional quality of fatty acids. Francesco *et al.* (2003) has reported similar variations due to unsaturation in different vegetable seed oils. The saponification val-

ues of oils of Hanoi (187.32) and Tillagang (186.67) varieties also indicated decreasing trend after roasting the seeds showing 161.11 and 178.32 for Hanoi and Tillagang varieties, respectively. This indicated that some of the fatty acids having high molecular weight were broken down into lower molecular weight fatty acids during roasting process. The insignificant variation in refractive index indicated that heating does not affects the structure of the oils obtained from raw and roasted seeds of both varieties, thus the oils are fit for edible purposes.

The seeds of *Arachis hypogea* showing an increase in their peroxide value in sand roasted oils of both varieties than the raw seeds oil. Which may be due to the formation of epoxide as a result of oxidation process (St. Angelo and Granes, 1986). The other physicochemical values of raw and roasted seed oils are more or less same with slight variations as reported earlier (Savage and Mcneil, 1998; Koman and Kotuc, 1976; Eheart *et al.*, 1955).

The fatty acid profile of the oils of both varieties of *Arachis hypogea* (Table 3) showed higher percentage of unsaturated fatty acid, which is the characteristic of good vegetable oil. Among saturated fatty acids, palmitic acid was present in high concentrations. Oleic acid was the major fatty acid in the raw and sand roasted peanut seeds 59-87% to 63.07% in Hanoi and 59.1% to 62.6% in Tillgang. This is a good contributor for

Table 1. The percentage of oils of raw and roasted seeds from *Arachis hypogea*

Physical character-istics	Raw Hanoi seeds	Sand roasted Hanoi seeds	Raw Tillagang seeds	Sand roasted Tillagang seeds
Yield of oil (%)	38.96% ± 1	38.42% ± 1	45.75% ± 1	43.83% ± 1
Refrective index	1.4633	1.4639	1.4635	1.4638

*The results are the average of the three independent experiments

Table 2. Physicochemical characteristics of oils of raw and roasted seeds from *Arachis hypogea*

Physicochemical characteristics	Raw Hanoi seeds	Sand roasted Hanoi seeds	Raw Tillagang seeds	Sand roasted Tillagang seeds
Peroxide value (meq/kg)	3.74	5.62	5.60	8.53
Iodine value (Wijis method)	95.68	87.96	101.38	89.42
Saponification value (mg KOH/kg)	187.32	161.11	186.67	178.32
Unsaponifiable matter (%age)	0.018	1.42	0.20	1.46
Acid value (mg NaOH/g oil)	0.3462	0.91	0 51	0.52
Free fatty acid (%age by wt.) as oleic acid	0.174	0.30	0.260	0.262
Ester value (mg/KOH)	186.97	160.52	186.15	177.81

Table 3. Fatty acid composition of lipids of raw and sand roasted seeds of *Arachis hypogea*

Fatty acid	Raw Hanoi seed	Sand roasted Hanoi seed	Raw Tillgang seed	Sand roasted Tallgang seed
Caprice acid ($C_{10:0}$)	tr	tr	tr	tr
Laurie acid ($C_{12:0}$)	tr	tr	0.2	tr
Myristic acid ($C_{14:0}$)	tr	tr	0.2	tr
Palmitic acid ($C_{16:0}$)	8.2	8.6	8.82	8.2
Palmitolic acid ($C_{16:1}$)	tr	tr	tr	T
Stearic acid ($C_{18:0}$)	3.9	2.8	3.7	3.1
Oleic acid ($C_{18:1}$)	59.87	63.07	59.1	62.6
Linoleic acid ($C_{18:2}$)	22.9	20.1	22.7	19.9
Linolenic acid ($C_{18:3}$)	1.3	1.3	1.84	1.8
Arachidic acid ($C_{20+higer}$) or above	3.7	3.9	3.6	3.8

tr = Traces

lowering the level of LDL (low density lipoprotein), while maintaining the HDL level (high density lipoprotein), which is useful to minimize the chances of the risk from cardiovascular diseases (Mata *et al.,* 1992; Mattson, 1985). Polyunsaturated fatty acids $C_{18:2}$ and $C_{18:3}$ were present in good quantity in raw and roasted oils of two peanut varieties which is helpful in controlling the serum cholesterol level. The present study indicated that some of the linoleic acid of both the varieties changes into oleic acid when the seeds were roasted in sand. The change observed 2.8% decrease in linoleic acid in both the varieties. Similarly, the stearic acid percentages of raw seed oil decreased after roasting while palmitic acid level was slightly increased. It is, therefore, imperative that raw seed oil of *Arachis hypogea* be promoted to enhance the availability of edible oil. The shelf life of raw seed oil is better than that from roasted seeds (Mason *et al.,* 1996). Raw seed oil from *Arachis hypogea* has also been used in blends with other oils to enhance their shelf life.

The present work indicated some changes in the physicochemical characteristics and chemical composition of the oil extracted after sand roasting of *Arachis hypogea* seeds, but the changes observed do not seem to the extent of showing any adverse effect on its nutritional aspects.

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