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Research Notes

An Investigation of Chemical and Physical Properties of Kordestan (Iran) Acorn

I. Alemzadeh[1], M. Vossoughi[1] and V. Maghsoodi[1]

ABSTRACT

Different layers of acorn (Quercus infectoria), hull, seed coat and seed kernel were analyzed for determination of chemical composition. The results of the preliminary analysis showed that acorn contained more than 65% carbohydrates, 8% lipid and 10% tannin among other constituents. The fatty acid composition of the seed oil was determined using thin layer chromatography and comparing with standards. The results showed the presence of both saturated and unsaturated fatty acids. Saturated fatty acid: are C_{14}:0, C_{16}:0, C_{18}:0, and C_{20}:0. Unsaturated fatty acid: C_{18}: 1 and C_{18}: 2. Total saturated fatty acids represented 20% and unsaturated fatty acids contributed 80% to acorn fat content.

Keywords: Acorn, Seed coat, Seed kernel, Tannin.

INTRODUCTION

Acorn is an important source of carbohydrate, lipid, protein and tannin. The carbohydrate, protein and lipid content of acorn have attracted attentions for its use as supplement in animal diet. Feldhamer and coworkers, 1989 have reported relationship between acorn production and deer body weight during different seasons. Osorio-Bueno and coworkers, 1985; Flores and coworkers 1988 reported the direct effect of nutrition of Iberian pig with acorn and mixed feed on the content of fatty acids in adipose tissue. Holiman 1985; Govindwar and Dalvi 1990 presented that acorn, due to its tannin content, could result in antinutritive effects when fed complete, without tannin layer separation. Tanguy and coworkers 1977, Mosely and Griffths, 1979 reported that the antinutritive effect of tannin is due to decrease in trypsin and a-amylase activities. Prakhavatti reported an inhibition on iron adsorption related to tannin content in either feed or food. Griffths and Jones 1977 concluded that water extract of the testa from colored flour containing tannin inhibited the action of fungal cellulase and reduced the *in vitro* digestibility of cellulose. So it was suggested that the evolutionary advantage of high tannin content may be related to the ability to inhibit the growth of pathogenic fungi (generally cellulolytic). On the other hand tannin content in ruminant diet needs more investigation and for the reasons of protein binding capability of tannin, cellulase inhibition and other problems connected with antinutritive effect in feed. Two approaches can reduce this antinutritive effect as reported by Tanguy and coworkers, 1977; Rao and Deosthale, 1982, for some tannin containing horse bean

[1] Biochemical and Bioenvironmental Research Center, Sharif University of Technology, Tehran, Islamic Republic of Iran.

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Table 1. Analytical data on acorn (%).

Layer	Protein	Lipid	Total carbohydrate	Tannin	Ash
Hull	0.50	1.44	50	15-20	2.72
Seed coat	0.20	0.05	-	40	1.69
Seed	5	7.80	70	1	1.55

seeds. Antinutritive effect could be reduced when the hull and seed coat are removed, also the processes of roasting or cooking can greatly decrease the tannin content. Acorn due to its lipid content, which is about 8%, could serve as a lipid source. Osorio-Bueno and coworkers, 1985; Flores *et al.* 1988 reported the lipid analysis of adipose tissue from pig fed on acorn. In this investigation different layers of Iranian acorn were analyzed separately and through thin layer chromatography (TLC) fatty acid composition of seed oil was identified.

MATERIALS AND METHODS

Acorn was harvested from the west of IRAN (Kordestan). The average weight of each nut was 5 g. The acorn was separated into three different parts namely, hull, seed coat, and seed, the weight of each part being as follows: hull 20%, seed coat 15% and seed 65%. Each part was ground separately in a coffee mill (Moulinex) .All the chemicals used were of analytical grade, obtained from Merck Co.

Tannin was estimated using the method reported by Rao and Deosthale, 1982. Nitrogen content was determined by the macroKejeldhal method and then expressed as crude protein using a conversion factor of 6.25. Total carbohydrate was estimated using the Anthrone method reported by Thomas 1977. Lipid content was determined in a Soxhlet extractor using petroleum ether as solvent (Guston and Mc.Laughlan,1976).

As for seed oil analysis, seeds were ground and oil content extracted with petroleum ether in a Soxlet extractor, solvent being removed in vacuo at 40^0C. Glyceride or esters existing in seed oil were hydrolyzed according to the procedure reported by Gustone and Mc. Laughlan, 1976.

Thin layer chromatography of seed oil and hydrolyzed samples were run as reported by Stahal, E. 1969, using silicagel G as adsorbent and ready coated plates of silicagel G(0.2mm thick)supplied by Merck Co., without prior activation. The substances were applied with a micropipette. The chromatoplates were developed in a tank filled to a height of 12.5 cm, at room temperature, with petroleum ether (BP 60-70^0C) diethyl ether and acetic acid (70-30-2 V:V:V).

Time of run was 1hr and visulization of constituents was via carbonization by heating with chromo sulfuric acid (5g potassium dichromate in l00ml 40% sulfuric acid at 150^0C). Visual composition of the sample, spot area and R_f (rate of flow) were evaluated by comparison with a suitable standard, using C_{14}:0, C_{16}:0, C_{18}.:0, C_{18}.:1, C_{18}.:2 fatty acids and in five replicates.

RESULTS AND DISCUSSION

The gross and approximate composition of the different parts of acorn are summarized in Table 1. It is clear that seed is the major source of carbohydrate, lipid, and protein. The most substantiate layer of tannin in acorn is in seed coat (40%) and hull (15-20%). By looking at the chemical composition of acorn, one can recognize its potential as an agricultural product and its use as supplement in animal feed particularly in regions with a lack of animal feed due to

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Table 2. Typical characteristic, physical properties of acorn seed oil.

Characteristic	Amount
Iodine value	80
Saponification value	188
Refractive index at 25^0C	1.469
Free fatty acid %	5.07
Unsaponifiable matter %	1.35

Table 3. R_f value and fatty acid composition of Iranian acorn seed oil.

Fatty acid	R_f	Amount (%)
C_{14}:0	0.62	0.2
C_{16}:0	0.70	15.3
C_{18}.:0	0.76	4.5
C_{20}:0	0.80	0.5
C_{18}:1	0.61	59.5
C_{18}:2	0.553	20.0

local climatic conditions. However the presence of phenolic compound (tannin) at 10% in acorn decreases its nutritive value. However this antinutritive effect of acorn could be reduced through the tannin containing layers being removed by cooking or roasting the grain, Tanguy *et al*. 1977; Griffiths and Jones, 1977; Rao and Doesthale, 1982. The analytical values of the oil presented in Table 2 are comparable with the previously reported data by Formo *et al*, 1982. Table 3 presents the R_f value of the fatty acids present in Iranian acorn seed oil resulted from hydrolysis and TLC application as well as the amount of fatty acids. Each value is the mean of five measurements. Table 4 represents some statistical calculations. None of the five, replicate measurements differ by more than ± 1 times the standard deviation from the mean. The mean value and Standard Deviation (S) has been calculated from the equations 1 and 2 (Hershdorfer, S.M. 1984). It is clear that both saturated and unsaturated fatty acids are present in seed oil, but the amount of unsaturated fatty acid is higher (80%) than saturated ones (20%). C_{16}:0 is the most prevalent saturated and C_{18}.:1 is the most comnon unsaturated fatty acid. Osorio-Bueno and coworkers, 1985 reported the presence of C_{14}:0, C_{16}:0, C_{18},:2 in adipose tissue of Iberian pig fed on protein and supplement of soybean and acorn. Flores *et al.* 1988 reported the presence of the fatty acids C_{14}:0, C_{16}:0, C_{18},:0, C_{18}.1, C_{18}.:2, and C_{18}:3 in adipose tissue of pigs fed on acorn. These authors also presented that palmitic acid about 20% shows the most important amount of saturated fatty acid and oleic acid about 55% has the highest amount of saturated fatty acid present in the pig fat fed on acorn. These are comparable with our analytical results of Iranian acorn.

$$H = \Sigma \frac{x}{n} \qquad (\mathbf{1})$$

H=The average of the 5 observations, arithmetic mean

ΣX=sum of the individual observations.

n=number of observations.

$$S = \sqrt{[\Sigma (X - H)^2 / n - 1]} \qquad (\mathbf{2})$$

S=Standard deviation

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Table 4. Some statistical data, mean and standard deviation, (S.D.) for fatty acid composition in Iranian acorn

Fatty acid	C_{14}:0	C_{16}:0	C_{18}:0	C_{20}:0	C_{18}:1	C_{18}:2
Mean	0.2	15.3	4.5	0.5	59.5	20
S.D.	0.036	1.2	0.58	0.025	2.4	3.35

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مطالعه پاره ای از مشخصات شیمیایی و فیزیکی میوه بلوط کردستان (ایران)

چکیده

لایه های مختلف میوه بلوط شامل پوسته خارجی، پوشش دانه و مغز دانه مورد بررسی شیمیایی قرار گرفت. نتایج مطالعات اولیه حاکی از آن است که بلوط شامل بیش از ٦٥ درصد قند، ٨ ردصد چربی و ١٠ درصد تانن می باشد. ترکیب اسیدهای چرب موجود در دانه با استفاده از روش کروماتوگرافی لایه نازک با مقایسه با استانداردهای موجود تعیین شد. نتایج حاکی از حضور اسیدهای چرب اشباع شامل میریستیک، پالمتیک اسید، استئاریک اسید و آراشیدنیک اسید و اسیدهای چرب غیراشباع اولئیک و لینولئیک می باشد. اسیدهای چرب اشباع ٢٠ درصد و غیر اشباع ٨٠ درصد چربی کل دانه را تشکیل می دهد.

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