Results and Discussion

4. RESULTS AND DISSCUSSION

4.1. Chemical composition of whole kernels and defatted meal in apricot and mango kernels seeds

The preliminary work carried on the apricot and mango kernel seed included the approximate analysis, determination of the chemical composition and evaluate the quality of the protein isolate.

The approximate chemical composition of whole apricot kernels defatted meal and protein isolate are given in Table (1) fats represent the major component the kernel (48.15%), followed by protein (25.14%) and total carbohydrates (16.3%). These results are almost similar to those reported by **Abd El-Aal and Hamza (1986)** removal of fats from apricot kernel resulted in a considerable increase in protein content(44.1%). The increase in the other constituent after defatting was expected.

Generally concluding apricot kernel considered a good source of protein and fats allowed extent as a source of carbohydrates in food processing.

The approximate chemical composition of whole mango kernels, defatted flour and protein isolate are given in Table (1). total carbohydrates represent the major component in the kernel (73.38%), followed by fat (10.31%) and protein (7.23%). These results are in agreement with the data obtained by **Seleim *et al.* (1999) and Zein *et al.* (2005).**

Generally concluding mango kernel meal considered a good source of carbohydrates in food processing.

Table (1): Chemical composition of whole kernels and defatted flour in apricot and mango kernel seeds:

COMPONENTS	APRICOT		MANGO	
	Whole Kernels	Defatted Meal	Whole Kernels	Defatted Meal
Moisture %	8.90	7.70	9.40	8.20
Fat %	48.15	2.80	10.31	1.72
Protein %	25.14	44.10	7.23	13.75
Ash %	5.51	4.10	5.13	3.65
Fiber %	2.45	4.50	2.95	5.21
Total carbohydrates %	16.30	28.20	73.38	75.67
Total cyanogenic %	0.18	0.25	0.05	0.09
Total phenolic compounds %	0.20	0.42	6.20	4.10
Phytic acid %	0.14	0.25	1.95	2.90
Tyrpsin inhibitor %	0.00	0.00	4.90	5.30

The antinutrative factors, total cyanogenic, total phenolic compounds and phytic acid in the apricot and mango kernel were 0.18-0.05%, 0.2-6.2% and 0.14-1.90% respectively. These data are in agreement by **Abd El–Aal and Hamza (1986) and Zein *et al.* (2005)**.

4.2. Physical and chemical properties of kernel oil:

Due to the shortage of edible oils particulary in developing countries, it has become necessary to not only develop new cultivars rich in its oil contents, but also search for new and non-conventional sources. So, apricot and mango seeds oils are extracted and some chemical properties are presented in Table (2)

Table (2): Physicochemical properties of Apricot and mango kernel seeds oils.

Physicochemical properties	Apricot seed oil	Mango seed oil
Refractive index	1.4714	1.4620
Specific gravity	0.9136	0.8980
Peroxide value	0.3	2.9
Iodine value	102	78
Saponification number	190	192
Acid value	1.1	4.1

4.2.1. Apricot:

Apricot seed oil was subjected to the routine analysis of the oils and fats. Physicochemical properties of an oil or fat determine to some extent, its possible application in either industry or nutrition. Table (2) refers to the physicochemical properties of the samples, which included the refractive index, specific gravity, acid value, peroxide value, saponification value and iodine value.

Refractive index of analysis of oils, its used for the estimation of their degree of unsaturation. From Table (2) it could be observed that the refractive index at 25°C of apricot seed oil is 1.4714. The refractive index near to that reported by **Own** ***et al.*** **(2001)**.

Specific gravity of the oil was 0.9136; this was found to be in harmony with those obtained by **Abd El-Aal** ***et al.*** **(1986)**.

The acid values of the investigated oil is lower than the value of **Rifique** ***et al.*** **(1986)** and near to the value reported by **Ismael and Badwwy.(1991) and Own** ***et al.*** **(2001).**

Data in Table (2) indicated that the saponification value (mg KOH/g oil) of apricot oil is 190.

Autoxidation in the oils was estimated by peroxide value. Data in Table (2) showed that the peroxide value found is relatively small. Such results clearly indicate that there is a little effect of autoxidation on the oils.

The iodine value serves as an indication of the degree of unsaturation. The iodine values of apricot oil under investigation were determined. The obtained results are presented in Table (2). The iodine values of Apricot oil under investigation are 102. These results indicate the presence of high concentration of unsaturated fatty acids in apricot oil, leads to an increase in its iodine values.

4.2.1.1. Fatty acid composition of apricot oil:

Fatty acids are the integral constituents of every fat or oil. The degree of complexity of the glycosides basically depends upon the number and amount of various fatty acids. Also, the physical and chemical characteristics of lipids are largely depended up on their fatty acid composition. Gas-liquid chromatography was used for the qualitative and quantitative analysis of individual fatty acid methyl ester.

Fatty acid composition of Apricot seed oil is presented in Table (3).The obtained results showed that apricot seed oil contains high amount of unsaturated fatty acids. The unsaturated fatty acid contents of Apricot seed oil are 96.11% of total fatty acid. Oleic acid ($C_{18:1}$) represents the major fatty acid (60.64%)., followed by linoleic acid ($C_{18:2}$) which represents (23.88%) and linoleic acid ($C_{18:2}$) which accounted (23.88%). As well as, the lowest amounts of saturated fatty acids palmitic acid ($C_{16:0}$) (11.21%) and stearic ($C_{18:0}$) (1.87%), lauric acid ($C_{12:0}$) (1.56%) and myristic ($C_{14:0}$) (0.45%). These results are lower than those of **Attia (2000) and Own *et al.* (2001).**

Table (3): Fatty acid composition of of apricot and mango kernel seeds oils.

Fatty acids	Apricot seed oil%	Mango seed oil%
Lauric acid	1.5782	1.41
Myristic acid	0.4459	1.56
Palmitic acid	11.2094	9.23
Palmitoleic acid	0.3842	-
Stearic acid	1.8671	1.49
Oleic acid	60.6383	49.70
Linoleic acid	23.8770	33.78
Linolenic	-	2.83

4.2.2. Mango:

Refractive index, specific gravity, peroxide value, iodine value, acid value and saponification number were determined. Needless to mention that such properties would give an indication about the possibility of uses of the produced crude seeds oils either for edible or industrial purposes.

As shown in table (2)mango seeds oil had refractive index 1.4620 this value agreed with that reported by **Walter** ***et al.*** **(1981)**

Specific gravity of the oil was 0.8980 which was found to be in harmony with that obtained by **Zein (2000).**

The acid value of the investigated oil is agreed with this reported by **Walter** ***et al.*** **(1981)** and lower than the value of **Zein (2000).**

Data in Table (2) indicated that the saponification value (mg KOH/g oil) of mango kernel oil is 192.It is agreed with the value reported by **Walter** ***et al.*** **(1981)** and higher than that reported by **Shahinaz (2001)**

Date in Table (2) revealed that the peroxide value of mango kernel oil is 2.9. These value showed that no oxidation have taken place in the extracted crude oil.

Iodine values reflect the unsaturation degree of the oil. Data in Table (2) showed that the iodine value of mango kernel oil is 58 it is low than the value reported by **Mohamed (2006)**

4.2.2.1. Fatty acid composition of extracted crude oil:

The fatty acid composition of extracted mango kernel oil was separated and identified using GLC and the results are given in Table (3). Mango kernel seed oil have high content of total unsaturated fatty acids Oleic acid ($C_{18:1}$) was the predominant fatty acid (49.70%) followed by linoleic acid ($C_{18:2}$) and a low amount of linolenic ($C_{18:3}$) in mango seed oil table (3).From the a forementioned data, it could be concluded that mango seed oil

Was characterized by a low level of saturated fatty acids. Total saturated fatty acid (13.69%), mainly, palmitic ($C_{16:0}$) (9.23%), myristic acid ($C_{14:0}$) (1.56%), stearic acid ($C_{18:0}$) (1.49%) and lauric acid ($C_{12:0}$) (1.41%).

It could be observed that apricot kernels oil had higher content of total unsaturated fatty acid (96.11%) than those found in mango kernels oil. It is worthy to mention that percentage of the unsaturated fatty acids of Apricot seeds oils were highly and reached approximately to (96.11%), especially, essential fatty acids (oleic and linoleic)which reflect the nutritional value of the oils.

Generally, it could be concluded that the studied extracted seeds oils had chemical properties in the normal rang of edible oils

Accordingly, seed kernel oils is more stable than many other vegetable oils rich in unsaturated fatty acids. Such oils seem to be suitable for blending with vegetable oils, strain manufacturing, confectionery industry and in the soap industry.

4.3. Effect of pH protein isolation from apricot and mango kernel meal:

Several experiments are carried out in order to establish the proper pH values required for apricot and mango protein extraction.

The obtained results are presented in Table (4) and Fig. (1). From these results it is shown that the maximum apricot and mango protein extraction were achieved at pH 10. on the other hand, results showed that on the acidic pH range, the percentage of the extracted protein was very low and reached its lowest amount at pH 5-4 (isoelectric point) in apricot and mango respectively. However, at basic pH (10) the percentage of the protein extracted were found to be 90:92% from apricot and mango kernel meal, respectively.

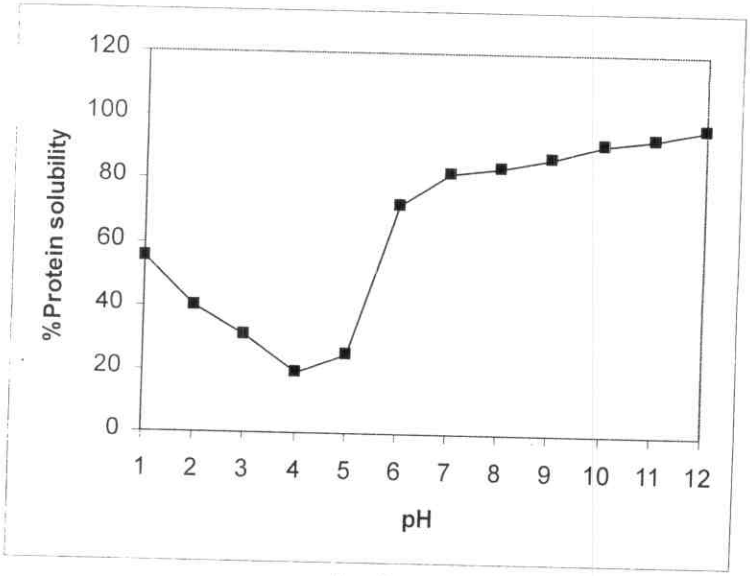
These results could be explained on the basis of the exhibited role of ionogenic groups in protein solutions. These proteins might be positively or negatively charged depending on the hydrogen ion concentration of the medium. The amount of NaOH bounds by the protein molecules depends on the equilibrium of hydrogen, **Wu and Sexson (1979).**

The ionogenic groups of proteins are present largly as Zweitter-ions at iso-electric point. Thus at the alkaline pH values the base displace the hydrogen from ammonium group $(-NH_3)^+$ of the Zweitter-ion giving negative charges to the protein molecule that would increase as the normality of the base is increases **Samir (1976).**

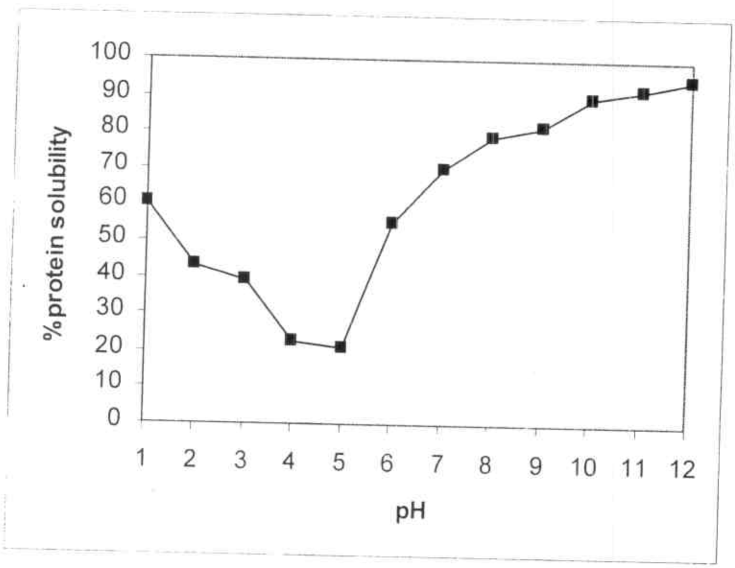
Solubility of a specific protein reaches to its minimum at the iso-electric point. **Wahba (1980)** noticed that the solubility of protein increases with increasing the acidity or alkalinity which might be attributed to the increase of repulsive electric forces induced by charges of some sign. That might exist of protein molecules.

Table (4): Effect of pH degree of extracting solvent on % protein extracts

pH	Apricot kernels	Mango kernels
1	55	60
2	40	43
3	31	39
4	19	23
5	25	21
6	72	55
7	82	70
8	84	79
9	87	82
10	92	90
11	94	92
12	97	95



Apricot



Mango

Fig (1): Effect of pH extracting solvent on % protein extract from apricot and mango seeds.

4.3.1. Chemical composition of protein isolate for apricot and mango kernel seeds:-

The data in Table (5) showed the chemical composition of apricot and mango protein isolate. It is clear that protein isolate has high protein isolate content (90.52-91.52%) low ash (2.5-2.13%) and fiber (5.69-0.97%), respectively. Free cyanoginic glycosides but it contains little amount of total phenolic compounds (0.00-1.65%) and phytic acid (0.13-0.24%), respectively. These results are in agreement with the data obtained by **Abd El–Aleem and Soltan (2005).**

Table (5): Chemical composition of apricot and mango meal protein isolate (on dry weight basis).

components	Protein Isolate of apricot kernel	Protein Isolate of mango kernel
Moisture %	7.60	8.10
Fat %	0.00	0.00
Protein %	90.52	91.52
Ash %	2.50	2.13
Fiber %	5.69	0.97
Total carbohydrates %	0.00	0.00
Total cyanogenic %	0.00	0.00
Total phenolic compounds %	0.00	1.65
Phytic acid %	0.13	0.24
Tyrpsin inhibitor %	0.00	0.00

4.4. Amino acids composition of apricot, mango kernel and protein isolate:

The amino acid contents in the hydrolyzates of defatted flour and protein isolate of apricot and mango kernels are shown in Table (6). Results indicate that Leu, Lys, Iso-leu and Val were the predominant essential amino acids in mango kernel seeds.

Table (6) shows that Lys, Val, and Trp were higher in mango seed kernels than of protein pattern **FAO /WHO (1973)**. Similar observations were recorded by **Dhingra and Kappor (1985)** in mango seed kernel.

Concerning the non-essential amino acids, Table (6) indicated that mango kernels contain the glutamic acid recorded as the higher value among the other detected amino acids. However, aspartic acid in the second order.

The data in Table (6) interpreted the cystein and methionine might be considered as the limiting amino acid, data in the present study revealed that mango kernel flour could be used as a good source of essential amino acids in food products. On the other hand, it is very poor in sulphar containing amino acid and can not be used as a single source of it.

The amino acids compositions of apricot kernel are presented in Table (6). Results indicate that glutamic and aspartic acids are the most abundant amino acids followed by argnine, cystine and methionine contents are found to be in minimum quantities 0.51% and 1.1%, respectively. However, the total essential amino acids content is 31% these results are in agreement with those reported by **Attia (2000).**

On the other hand, the results also indicated that protein isolates exhibited some changes in amino acid contents when compared with the defatted flour. According to **Seleim *et al.* (1999)**, they reported that these changes might be due to the non-perceptible proteins during the preparation of protein isolate.

Table (6): Amino acid composition of apricot, mango kernels and protein isolate (g/100 g protein)

Amino acids	Apricot		mango	
	Kernels	Protein isolate	Kernels	Protein isolate
E.A.A				
Lys	3.16	3.22	5.68	5.12
Leu	6.35	6.38	6.73	6.59
Iso-leu	3.66	3.68	5.23	4.81
Cys	0.43	0.51	0.48	0.46
Met	0.95	1.10	1.15	1.22
Phe-ala	4.60	4.50	3.15	3.12
Tyr	3.40	3.50	1.95	1.82
Thr	3.10	3.40	2.84	3.12
Val	3.87	3.92	4.96	5.33
Try	1.30	1.30	1.69	1.82
T.E.A.A	30.82	31.51	33.86	33.41
N.E.A.A				
His	2.36	2.17	3.25	3.10
Arg	8.60	9.13	4.84	5.21
Asp	11.30	11.14	9.21	8.62
Glu	18.40	17.33	19.62	17.90
Ser	4.10	3.80	4.83	4.19
Pro	5.30	5.30	2.83	3.31
Gly	4.10	4.30	4.70	4.31
Ala	4.50	4.10	5.30	4.82
T.N.E.A.A	58.66	57.27	54.58	51.46
T.A.A	89.48	88.75	88.44	84.88

4.5. Effect of different treatments on the removal of antinutritional factors from apricot and mango kernel meal:

Soaking apricot kernel seeds in water and sulphite caused a gradual decline in all antinutrittional factors examined during 72 h soaking period Fig. (2). This processing method is effective in removing 44-72% polyphenol, 16-40% phytic acid and 20-55% HCN.

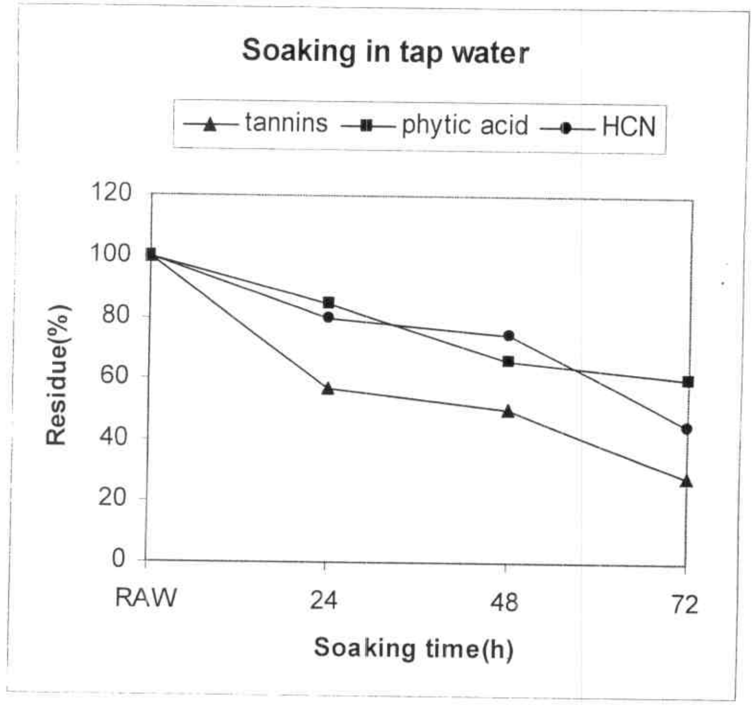
The results in Fig. (3) referred that the cyanogenic glycosides were totally destroyed after autoclaving. The data in Fig. (2) indicated that treatment with soaking in water and heated gave the highest removal of polyphenols from kernel meals but the color of meal after treatment was found to be green and dark green.This color due to the oxidation of chlorogenic acid and limits the use of meal in the food industry.

From the abovementioned results it is indicated that treatment of kernel with sulphite (reducing salts) removed most polyphenols.

These reducing agents prevents the accumulation of qinones which may be participate in reaction leading to colored products (**Gheyasuddin *et al.*, 1970**).

Soaking mango seed kernels in water and sulphite caused a gradual decline in all antinutritional factors examined during 72 h soaking period Fig. (4).This processing method is effective in removing 35-63% of polyphenol 41-60% trypsin inhibitor and 22-47% phytic acid.

Soaking in sulphite was more effective than water in removing antinutritional factors.The results presented in Fig. (5) indicated that heating was more effective than soaking inactivating trypsin inhibitor but heating kernel soaked for 48h resulted in the removal of high amounts of antinutritional factors and similar results were reported also by **Arogba (1997) and Zein *et al.* (2005)**



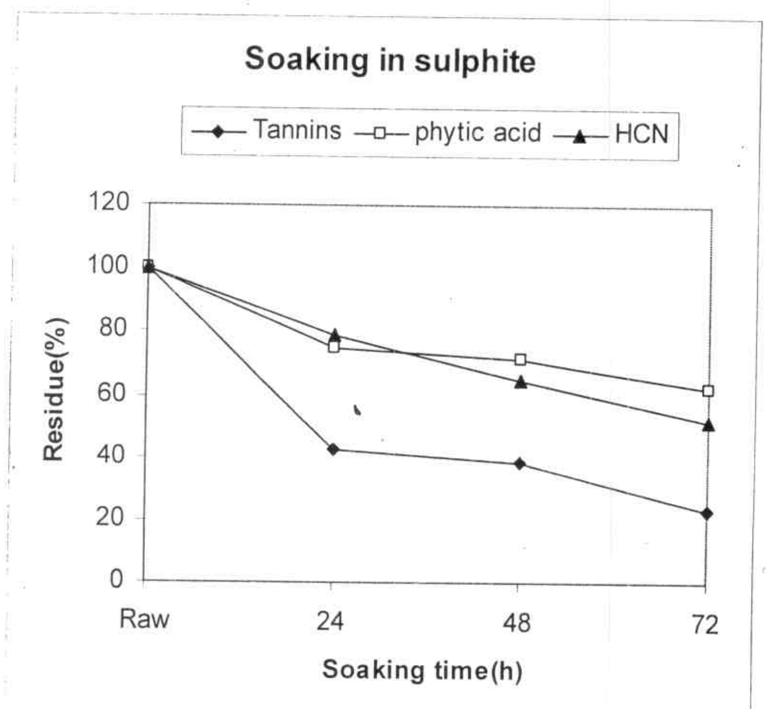


Fig. (2): Effect of soaking in tap water or in sulphite on tannins, HCN and phytic acid content in apricot seeds kernel defatted.

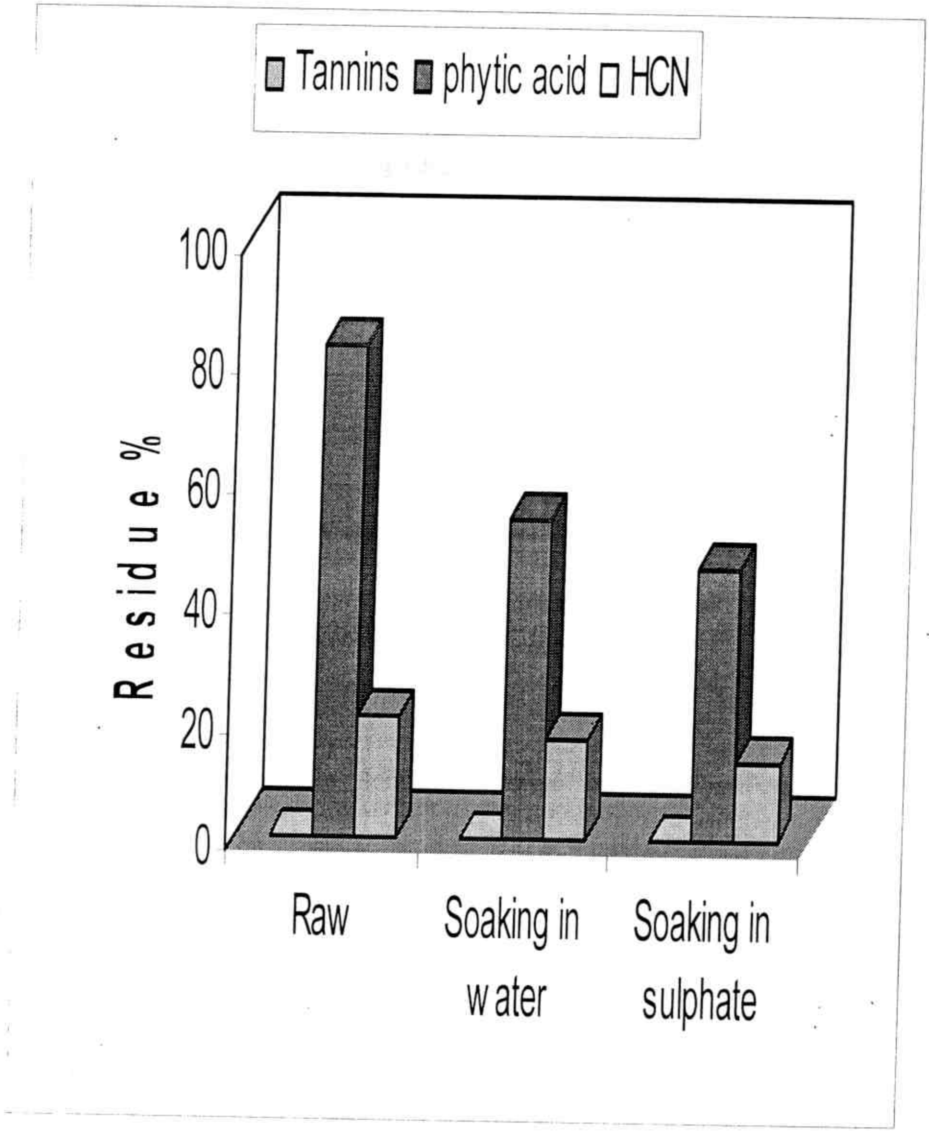


Fig (3) Effect of autoclaved after different soaking for 48 h on antinutritional factors in apricot seeds kernel defatted.

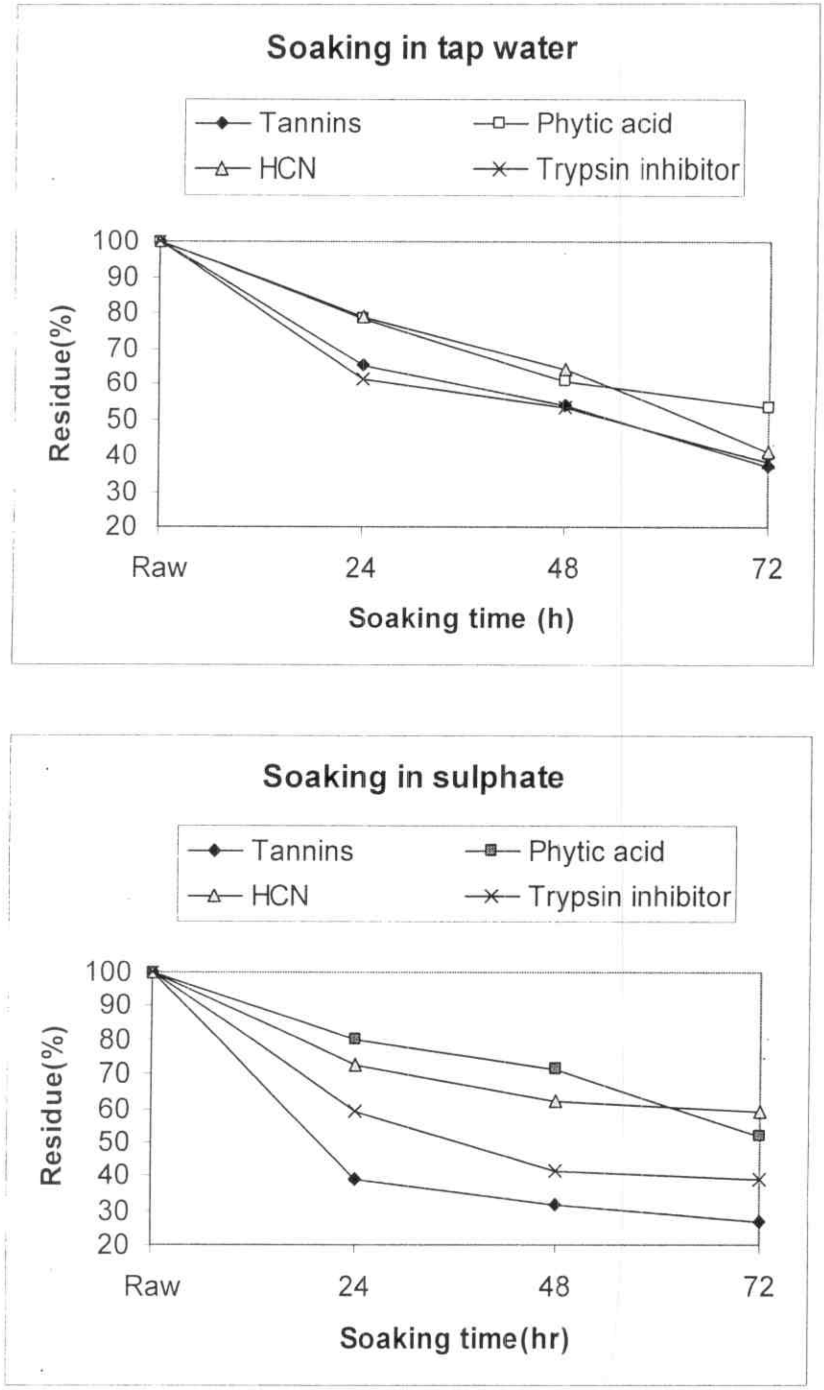


Fig (4): Effect of soaking in tap water or in sulphite on tannins, HCN, phytic acid and trypsin inhibitor (Ti) content in mango seeds kernel defatted.

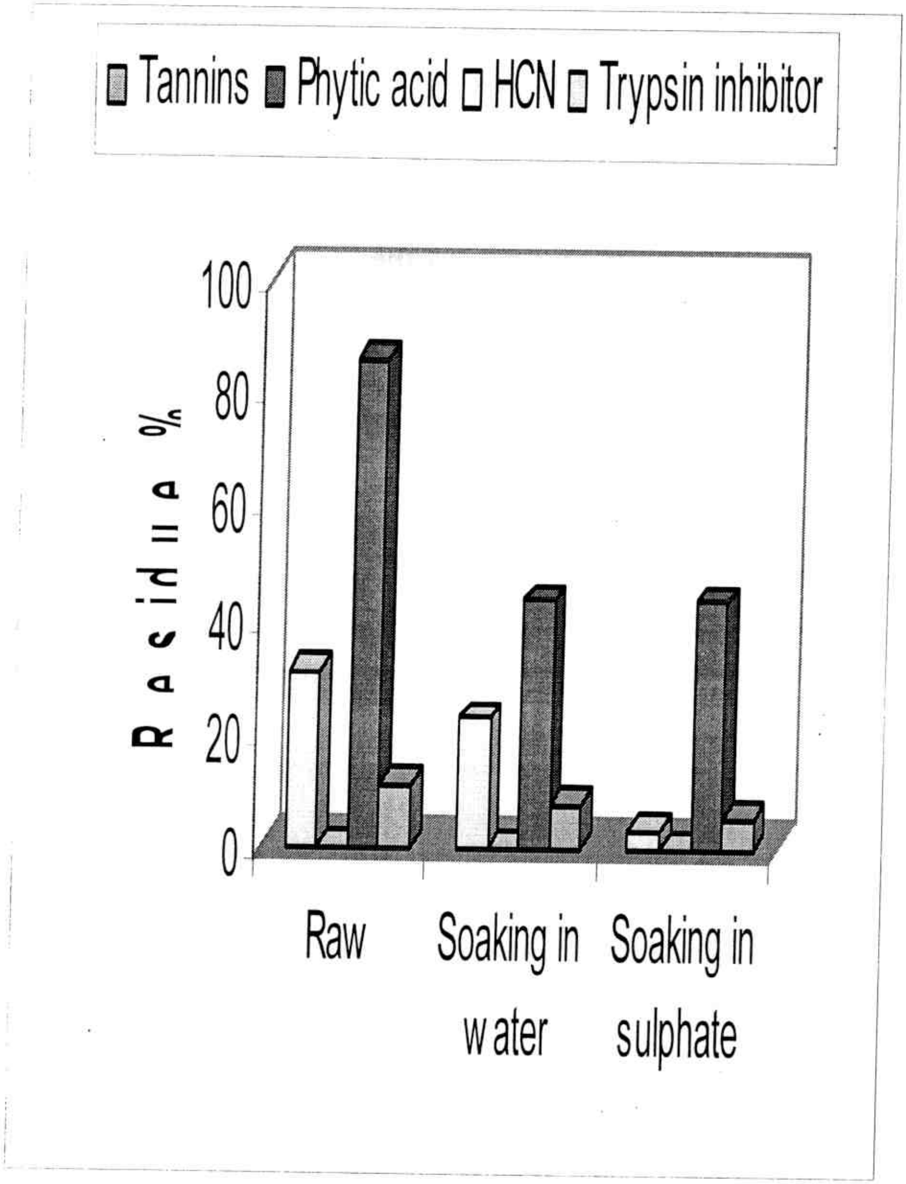


Fig. (5): Effect of autoclaved after different soaking for 48h on antinutritional factors in mango seeds kernel defatted.

4.6. Chemical composition of biscuits produced from soft wheat flour (72% extraction) rate substituted with mango seed kernels or defatted apricot seed kernels meals.

Data in Table (7) indicates the chemical composition of biscuits as influenced by different levels of mango seed kernels or defatted apricot seed kernels meals.

It was found that, fat, crude fiber and ash increased with increasing the different levels of defatted mango seed kernels meal. While crude protein and total carbohydrates slowly decreased with increasing the level of mango seed kernels. But; crude protein in biscuit prepared from blends with defatted apricot seed meals were increased with increasing the different levels addition.

4.7. Organoleptic evaluation of biscuits produced from soft wheat flour 72% extraction rate substituted with mango seed kernels or defatted apricot seed kernels meals.

It shown in Fig (6) that the picture of different biscuit blends.

The sensory characteristics, i.e. color, texture, taste, flavor, appearance and overall acceptability of biscuits prepared from wheat flour containing mango kernels meal with different levels were evaluated by ten panelists and the data obtained were statistically analyzed as shown in Table (8).

Table (7): Chemical composition of biscuit produced from soft wheat flour 72% extraction rate substituted with mango seed kernels or apricot seed kernels meals (mean±).

Components	Control	Treatments							
		1	2	3	4	5	6	7	8
Moisture %	5.50±0.23	5.62±0.21	5.78±0.26	5.45±0.18	5.80±0.20	5.46±0.28	5.28±0.33	5.25±0.36	5.66±0.24
Crude protein* %	8.41±0.18	8.35±0.12	8.28±0.15	8.18±0.20	8.06±0.16	10.08±0.21	12.27±0.42	14.15±0.48	16.53±0.18
Ether extract* %	12.06±0.14	12.38±0.10	12.66±0.16	12.90±0.31	13.27±0.15	14.98±0.18	15.70±0.26	16.40±0.38	17.27±0.25
Crude fiber* %	0.50±0.06	0.58±0.05	0.63±0.06	0.70±0.06	0.82±0.0.08	0.80±0.30	0.93±0.18	1.14±0.12	1.36±0.08
Ash* %	1.08±0.06	1.12±0.08	1.20±0.05	1.31±0.04	1.38±0.12	1.50±0.12	1.72±0.23	2.00±0.10	2.46±0.12
Total carbohydrates*@%	77.95	77.57	77.23	76.89	76.47	72.64	69.38	66.21	62.38
Energy value (kcal/g)	444.01	445.18	446.11	446.55	447.77	456.46	459.13	460.72	463.29

* : On dry weight basis. @ : by difference.
Control : 100% Wheat flour 72% extraction rate.
1: 95% wheat flour + 5% mango seed kernels meal.
2: 90% wheat flour + 10% mango seed kernels meal.
3: 85% wheat flour + 15% mango seed kernels meal.
4: 80% wheat flour + 20% mango seed kernels meal.
5: 95% wheat flour + 5% apricot seed kernels meal.
6: 90% wheat flour + 10% apricot seed kernels meal.
7: 85% wheat flour + 15% apricot seed kernels meal.
8: 80% wheat flour + 20% apricot seed kernels meal.

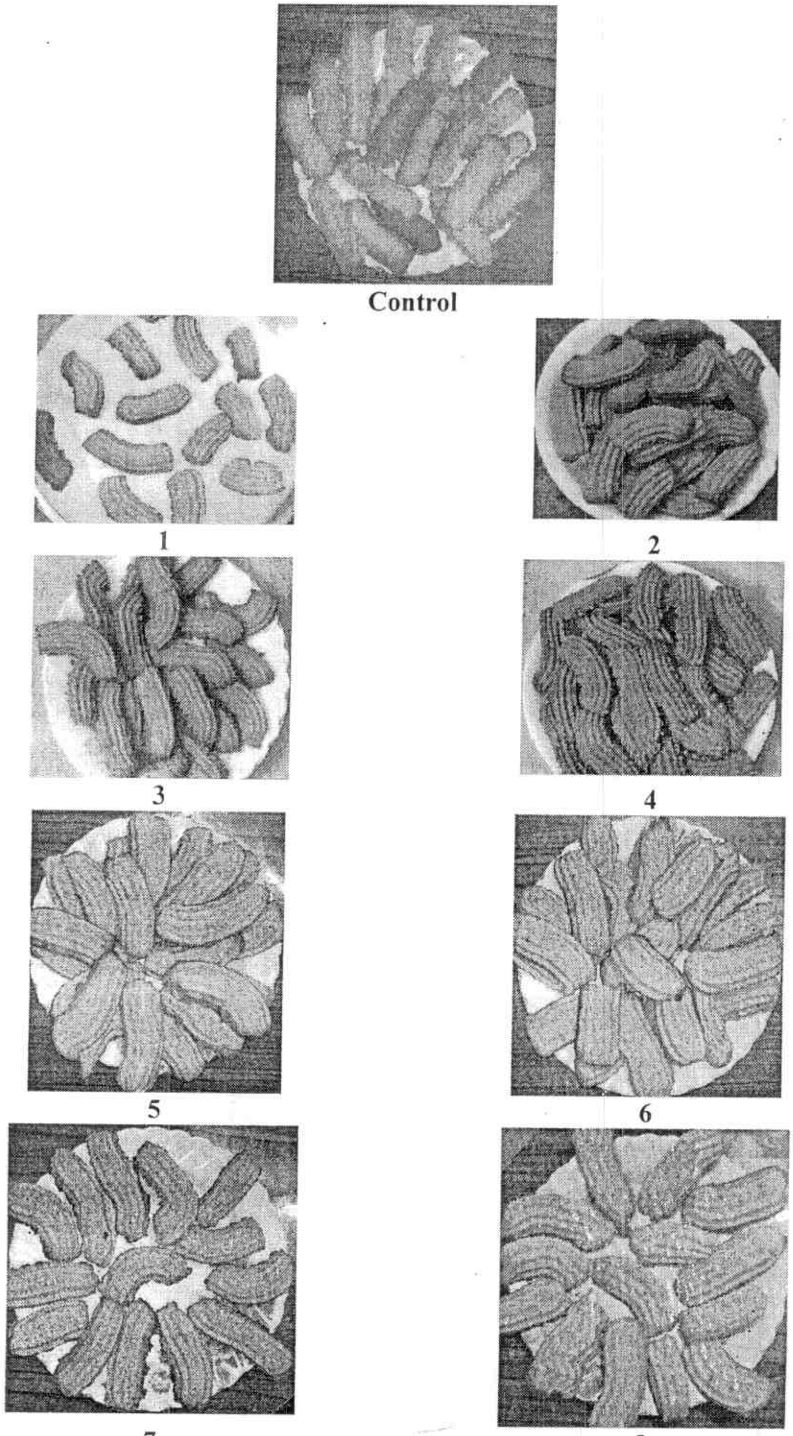


Fig. (6): Picture of biscuit prepared from wheat flour (72% ext. rate) (control) and prepared from other treatments (1-8):

Control : 100% Wheat flour 72% extraction rate.

1: 95% wheat flour + 5% mango seed kernels meal.
2: 90% wheat flour + 10% mango seed kernels meal.
3: 85% wheat flour + 15% mango seed kernels meal.
4: 80% wheat flour + 20% mango seed kernels meal.
5: 95% wheat flour + 5% apricot seed kernels meal.
6: 90% wheat flour + 10% apricot seed kernels meal.
7: 85% wheat flour + 15% apricot seed kernels meal.
8: 80% wheat flour + 20% apricot seed kernels meal.

Table (8): Sensory evaluation of biscuits produced from soft wheat flour supplemented with different levels of mango seed kernels or apricot seed kernels meals (mean±SE).

Treatment	Color	Texture	Taste	Flavor	Appearance	Overall acceptability
Control	8.91±0.11 a	8.87±0.12 a	8.78±0.12 a	8.87±0.14 a	8.82±0.11 a	8.87±0.09 a
1	8.33±0.25 ab	8.73±0.16 a	8.64±0.24 a	8.73±0.14 a	8.55±0.23 a	8.39±0.13 ab
2	7.34±0.15 cd	8.60±0.24 ab	8.46±0.19 a	8.55±0.32 ab	7.52±0.16 b	7.87±0.22 bc
3	6.57±0.19 e	7.97±0.17 cd	7.92±0.27 b	8.42±0.24 abc	6.71±0.15 c	7.22±0.18 de
4	5.63±0.24 f	7.11±0.14 e	7.38±0.15 cd	8.08±0.16 bc	5.72±0.09 d	6.80±0.22 e
5	8.65±0.10 a	8.85±0.18 a	8.70±0.20 a	8.68±0.12 a	8.60±0.18 a	8.58±0.12 a
6	7.90±0.18 bc	8.70±0.14 ab	8.52±0.16 a	8.48±0.18 a	7.74±0.24 b	7.94±0.16 bc
7	7.12±0.22 de	8.28±0.15 bc	7.64±0.12 bc	8.14±0.08 bc	6.50±0.16 c	7.46±0.24 cd
8	6.18±0.10 ef	7.80±0.08 d	7.10±0.10 d	7.98±0.14 c	5.52±0.14 d	7.10±0.18 de
L.S.D. at 0.05	0.73	0.43	0.33	0.48	0.38	0.53

a, b, c and d: There is no significant difference ($P<0.05$) between any two means, within the same column. have the same letter

Control : 100% Wheat flour 72% extraction rate.

1: 95% wheat flour + 5% mango seed kernels meal.
2: 90% wheat flour + 10% mango seed kernels meal.
3: 85% wheat flour + 15% mango seed kernels meal.
4: 80% wheat flour + 20% mango seed kernels meal.
5: 95% wheat flour + 5% apricot seed kernels meal.
6: 90% wheat flour + 10% apricot seed kernels meal.
7: 85% wheat flour + 15% apricot seed kernels meal.
8: 80% wheat flour + 20% apricot seed kernels meal.

The obtained data could be noticed that supplemented with 5% mango seed kernels or defatted apricot seed kernels meals to soft wheat flour 72% extraction rate produced biscuits with average grade of like very much for all the evaluated attributes without significant difference ($p>0.05$) compared to control. In spite of, addition of mango seed kernels meal up to 10% showed significant decrease ($p<0.05$) in some sensory attributes of biscuits, average grade of all quality attributes were greater than 7. This indicates that the produced biscuit with 10% defatted mango or apricot seed kernels meals has like moderately quality grade. Also, biscuits supplemented with mango seed kernels or defatted apricot seed kernels meals until 15 and 20% have significant differences ($p<0.05$), compared to control, but they obtained like slightly quality grade.