IV. Results and Discussion

In an attempt to investigate the effect of wheat flour extraction rate on the processing conditions of instant noodles, the present study was carried out to investigate the chemical characteristics of their starting materials, rheological and technological properties of their doughs , kind of natural additives or substitutes to wheat flour in noodle doughs and level of substitution of these natural materials, technology and processing conditions (steaming time as well as, temperature of frying the cooking quality properties, sensory attributes, and storage stability parameters of experimental instant noodles prepared from both the starting wheat flours and their corresponding substituted noodles . Therefore, the present study as divided into nine research parts as follows :

1. Chemical analyses of materials used in the experimental preparation of instant noodles:
2. Preliminary study of the effect of wheat flour extraction rate, kind and substitution level of some natural products on the chemical composition and cooking quality of experimental instant noodles .
3. Study of the effect of wheat flour extraction rate , kind and substitution level of some natural products on rheological properties of dough's of the experimental instant noodles.
4. Study of the effect of variation in wheat flour extraction rate kind and substitution level of some natural products on some technological characteristics of steamed instant noodles.

5. Study of the effect of variation in wheat flour extraction rate, kind and substitution level of some natural products on cooking quality of the experimental fried instant noodles.
6. Study of the effect of variation in wheat flour extraction rate , kind and substitution level of some natural products on proximate chemical composition of the experimental instant noodles.
7. Study of the effect of variation in wheat flour extraction rate , kind and substitution level of some natural products on essential mineral content of the experimental instant noodles.
8. Study of the effect of wheat flour extraction rate , kind and substitution level of some natural products on organoleptic properties of the experimental instant noodles.
9. Study of the storage stability parameters of the experimental instant noodles as influenced by kind and substitution level of some natural products.

4.1. Chemical composition of materials used in the experimental preparation of instant noodles:

All the starting materials, wheat flours and some selected natural products to be examined for their chemical suitability to substitute wheat flour in making instant noodles were analyzed for their gross chemical composition.

4.1.1. Starting wheat flours of different extraction rates:

Three wheat flours (WF) , of different extraction (ext.) rates, used for the preparation of experimental instant noodles were analyzed chemically. The WF investigated included 82% WF, commercially used for production of Baladi bread in Egypt ; 72%

WF, commercially used for production of white pan bread , and 65% WF, which is used in the market to produce high quality baked products

4.1.1.1. Proximate chemical composition of starting wheat flours:

The proximate chemical composition of wheat flours of different extraction rates (82%, 72%, and 65% extraction) used for the preparation of experimental instant noodles are presented in table (4) and illustrated in Fig. (3).

Table (4): Chemical composition of raw materials used in the experimental preparation of instant noodles.*

Raw materials*	Component**					
	Protein (%)	Ash (%)	Crude Fiber (%)	Crude fat (%)	***Total carbohydrates (%)	Moisture (%)
Wheat flour (82% extraction)	14.49	1.59	1.60	1.53	80.79	12.32
Wheat flour (72% extraction)	12.40	0.76	0.50	1.30	85.04	12.10
Wheat flour (65% extraction)	11.80	0.69	0.31	1.04	86.16	10.33
Okara dry flour	35.80	3.88	7.12	7.12	46.00	13.80
Dry powdered orange albedo	4.49	3.47	17.36	0.59	64.09	10.00
Corn flour	8.95	1.40	3.00	5.50	71.90	11.00
Dry powdered beet root	1.20	5.5	1.20	0.10	84.8	7.20

* On dry weight basis.

** Average of triplicate trials.

***Calculated by difference.

Results indicated that the wheat flour 82% extraction (ext.) was the highest in contents in crude proteins , ash and crude fibers, but the lowest in total carbohydrates compared to those flours of 72% and 82% extraction. Alternatively, the 65% extraction flour contained the lowest proteins, ash, fibers and fat contents, but the highest total carbohydrates compared to those flours of 72% and 82% extraction.

These differences in the proximate chemical composition of the three wheat flours could be attributed to the difference in milling techniques which results in difference in bran layer content which increases as extraction rate of flour increases as reported by **(kruger *et al.*, 1994 , Shouk 1996 and Foda *et al.*,1997)**

The obtained results of chemical composition of wheat flours under study were found to be in agreement with those reported by **Mohamed (1992) ; Hussein and El-Akel (1993) ; , El-Badrawy (1994) ; Shouk (1996) ; Abu El Azm (1999); Mohamed (2000) and Ally (2001).**

4.1.1.2 .Carbohydrate composition of starting wheat flours:

The carbohydrate composition of wheat flours of different extraction rates (82%, 72%, and 65% ext.) used for the preparation of experimental instant noodles are illustrated in tables (5) and in Fig. (4).

Total carbohydrates constituted the major component in wheat flours. However, 65% ext. flour exhibited the highest total carbohydrates (86.11%) followed by the 72% ext flour (84.5%) then the 82% ext. which had the lowest content (81.5%). Starch comprised the major carbohydrate in the three wheat flours where the 65% ext. flour exhibited the highest amount (86.11%)

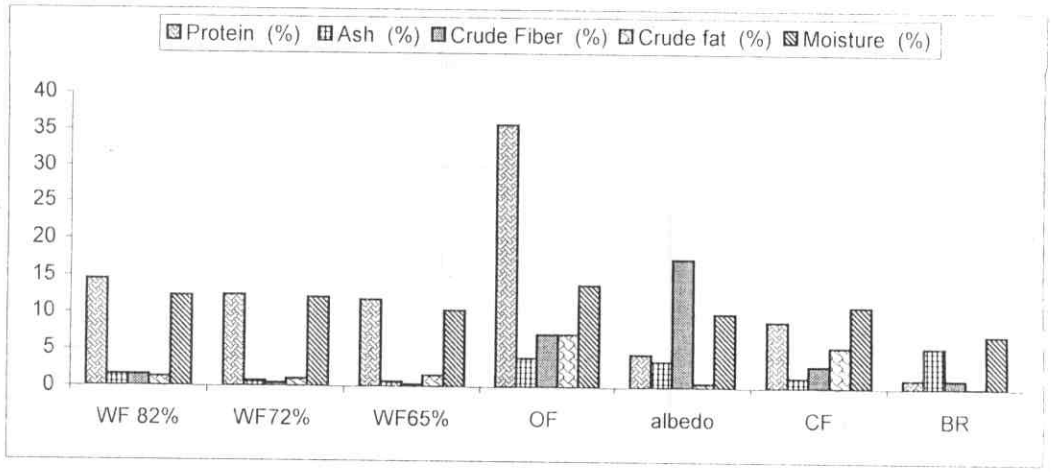


Fig (2): Chemical composition of materials used in the experimental preparation of instant noodles (WF: wheat flour of 82, 72 and 65% ext. ; **OF** : okara flour; **ALBEDO**: dry powdered orange albedo ; **CF**: corn flour ; and **BR**: beet roots).

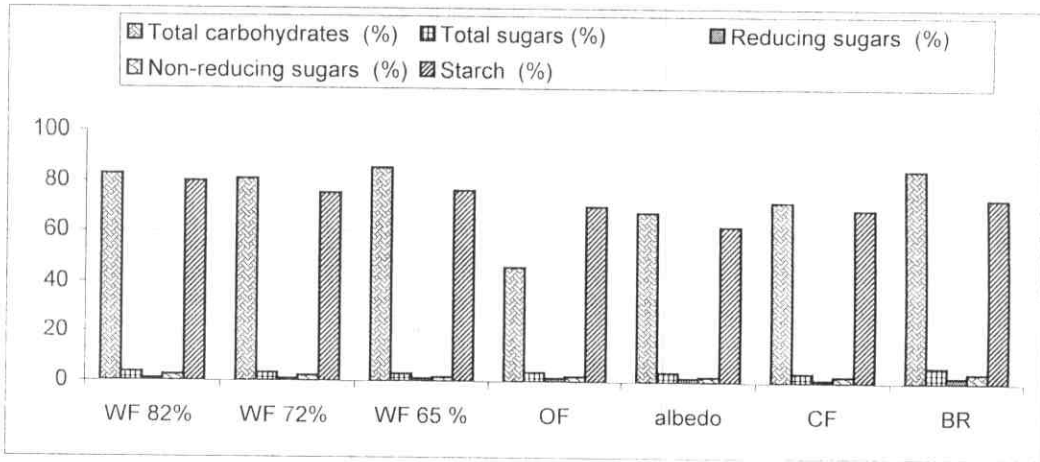


Fig (3):Chemical analyses of carbohydrates present in the materials for the experimental preparation of instant noodles (WF: w flour of 82, 72 and 65% extraction ; **OF:** okara flour ; **ALBEDO** powdered orange albedo; **CF**: corn flour and **BR**: beet roots) .

Table (5): Chemical analyses of carbohydrates present in the materials used for the experimental preparation of instant noodles.*

Raw materials*	Component**				
	Total carbohydrates (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Starch (%)
Wheat flour (82% extraction)	81.50	3.69	1.00	2.69	75.33
Wheat flour (72% extraction)	84.50	3.40	1.09	2.31	76.39
Wheat flour (65% extraction)	86.11	3.15	1.30	1.85	80.02
Okara dry flour	46.00	3.79	1.60	2.19	30.03
Dry orange albedo	64.09	4.00	1.75	2.25	62.17
Corn flour	71.9	3.79	1.19	2.60	69.00
Dry powdered beet root	84.8	6.33	2.33	4.0	73.33

* On dry weight basis.

** Average of triplicate trials.

*** Calculated by difference.

followed by the 72% ext flour (84.5 %) then the 82% ext. which had the lowest content (81.5%) .

Total soluble sugars, reducing and non-reducing sugars contents were the highest in the 82 % ext. flour (3.69, 1.00 and 2.69 %, respectively), but were the lowest in the 65 % ext. flour WF (3.15,105 and 1.10 %, respectively).

4.1.2. Starting natural additives or substitutes:

Some selected natural agriculture products; namely, okara flour (OF), dry powdered albedo of orange peels (ALBEDO), corn flour (CF), dry powdered beet roots (BR) were selected to be used as possible substitutes for wheat flours of different extraction rates(82%, 72%, and 65% extraction) in preparation of fried instant noodles.

4.1.2.1. Proximate chemical composition of starting natural additives or substitutes:

The proximate chemical composition of some selected natural substitutes used for the preparation of experimental instant noodles are illustrated in table (4) and Fig.(3).

From the obtained results, it could be noticed that, in an descending order, okara contained the highest content in protein (35.8%), followed by CF (8.95%) then albedo of orange peels (4.49%) while the lowest content was observed with dry powdered beet roots (1.2%).

In an descending order, albedo of orange peels contained the highest percentage of crude fiber (17.36%) followed by OF (7.12%) then corn flour (3%) and finally BR (1.2%). Beet roots contained the highest percentage of ash (5.5%) followed by OF (3.88 %) then Albedo (3.47%) and finally corn flour (1.4%).

The crude proteins value found for dry orange albedo was lower than that reported by many researchers from Egypt **(Hamed ,1985 ;Abu El-Maati, 1999)** as well as from other countries **(Crandall *et al.*,1983 ;Grohmann *et al.*, 1995).** However, the found value for crude fibers was consistent to that reported by **Neumark(1970)** and higher to that found by **Devendra and Gohl (1970)**

On the other hand, the crude proteins value found for okara was higher to that found by others investigators in Egypt (**Mahmoud *et al***

,1996 ; El-Safty ,1998) as well as from other countries **(Khare *et al* ,1993 ; O' Toole ,1999**

4.1.2.2. Carbohydrate composition of starting natural additives or substitutes:

The carbohydrate chemical composition of some selected natural substitutes used for the preparation of experimental instant noodles are illustrated in table (5) and Fig. 4.

Total carbohydrates constituted the major component in all the tested natural products, regardless of the kind of substitute. In an decreasing order, beet roots exhibited the highest total carbohydrates (84.8%) content followed by corn flour (71.9 %), then orange albedo (64.0%) and finally okara flour (46.0%). Starch comprised the major carbohydrate in all the tested natural products regardless of the kind of substitute, where it formed , in an descending order, 73.33% in BR, 70 % in OF , then 69 % in CF and finally 62.2 % in ALBEDO. As for total sugars , the highest content was found in BR (6.33%) ,followed by ALBEDO (4%), while both CF and OF showed the lowest content (4.8%).

beet roots showed the highest content in reducing and non-reducing sugars (2.33% and 4.0%, respectively) followed by albedo (1.75% and 2.25 %, respectively).

4.2. Preliminary study of the effect of wheat flour extraction rate , kind and substitution level of some natural products on the chemical composition and cooking quality of experimental instant noodles:

For the purpose of the investigating the suitability of wheat flour of different extraction rates (82% and 72%) and also screening of some selected natural products; (namely, okara flour, dry powdered albedo of orange peels, corn flour , dry powdered beet roots , green leaves of rocket salad and peels of potato) ; as well as to explore the possible level of substitution of these additives which proved to be successful to substitute wheat flour in producing acceptable fried instant noodles from the standpoints of chemical characteristics, technological and quality attributes, a preliminary screening study was performed and planned according to system illustrated in table 2A. Graded levels from 1 to 3% of either rocket salad, potato peels, okara flour, Albedo and beet roots as well as from 4 to 8% of corn flour were investigated to substitute both the two wheat flours tested. However, both rocket salad and potato peels were excluded at once because they developed unacceptable color and odor when they used at even at 1% level of substitution in making instant wheat noodles as demonstrated in the photographs presented in Fig.4.

4.2.1. Preliminary study on the chemical composition of experimental noodles:

Preliminary study on the proximate chemical composition of the experimental instant noodles prepared from both wheat flours of 82% and 72% extraction rate only (controls) and their corresponding noodle groups prepared using the four tested substitutes at the level of 1-3 % for OF, ALBEDO and BR or at the level of 4-8% CF are presented in tables 6 and 7 . As expected, the 82% ext. WF noodles showed higher content in crude proteins, crude fibers and ash than the 72 % ext. WF. Subsequently, all the fried noodles prepared from 82% ext. WF with any of the tested substitutes showed commonly the same trend of higher content in crude proteins, crude fibers and ash than the corresponding noodles prepared from the 72% ext. WF.

The substitution of each kind of the tested material induced certain changes in the proximate chemical composition of their fried noodles: the OF group showed slight higher protein, ALBEDO group showed slight higher crude fiber , but the CF group showed slight reduced protein content. It appeared that the tested lower level of substitution for all the screened natural products (from 1 to 3% of OF , ALBEDO and BR or at the level of 4 to 8% CF) did bring about remarkable changes in the proximate chemical composition of their fried noodles and , therefore, the level of substitution must be increased.

Table (6): **Preliminary study on the chemical composition of fried instant noodles produced from wheat flour 82% ext. (WF) substituted by graded levels of okara dry flour (OF), dry orange albedo (Albedo), corn flour and dry powdered beet root (BR), (% on dry weight basis).**

Raw materials	Sample No.	Substitution level (%)	Analyses					
			Crude protein (%)*	Fat (%)*	Ash (%)*	Crude fiber (%)*	Moisture (%)*	Total carbohydrates**
Control group (WF) Wheat flour 82% ext.	1	0	14.21	19.00	1.50	1.6	6.00	57.2
Okara flour group (OF)								
99% WF + 1% OF	2	1	14.65	19.00	1.60	1.65	6.00	57.10
98% WF + 2% OF	3	2	14.91	19.10	1.62	1.68	5.89	56.80
97% WF + 3% OF	4	3	15.06	19.5	1.64	1.74	5.80	65.30
Dry powdered orange albedo group (Albedo)								
99% WF + 1% Albedo	5	1	14.75	20.01	1.60	1.75	5.99	55.90
98% WF + 2% Albedo	6	2	15.10	19.16	1.61	1.88	6.11	56.14
97% WF + 3% Albedo	7	3	14.13	19.99	1.63	2.04	6.00	56.21
Corn flour group (CF)								
96% WF + 4% CF	8	4	14.23	19.90	1.55	1.52	5.9	56.9
94% WF + 6% CF	9	6	14.12	19.02	1.55	1.65	5.8	57.88
92% WF + 8% CF	10	8	14.00	19.16	1.54	1.67	5.00	58.63
Dry powdered beet root group (BR)								
99% WF + 1% BR	11	1	14.30	19.22	1.58	1.59	5.70	57.61
98% WF + 2% BR	12	2	14.20	21.01	1.57	1.56	5.63	56.03
97% WF + 3 % BR	13	3	14.00	21.23	1.56	1.56	5.38	56.27

* Average of duplicate determination.

** Calculated by difference.

ıble (7): Preliminary study on the chemical composition of fried instant noodles produced from wheat flour 72% ext. (WF) substituted by graded levels of okara dry flour (OF), dry orange albedo (Albedo), corn flour and dry powdered beet root (BR), (% on dry weight basis).

Raw materials	Sample No.	Substitution level (%)	Analyses					
			Crude protein (%)*	Fat (%)*	Ash (%)*	Crude fiber (%)*	Moisture (%)*	Total carbo-hydrates**
ontrol group (WF)								
/heat flour 72% ext.	1	0	12.21	19.50	0.71	0.49	6.00	61.09
kara flour group (OF)								
99% WF + 1% OF	2	1	12.35	20.00	0.77	0.54	5.95	60.4
98% WF + 2% OF	3	2	12.61	20.01	0.80	0.61	5.92	60.05
97% WF + 3% OF	4	3	12.76	21.30	0.83	0.68	579	58.4
ry powdered orange lbedo group (Albedo)								
99% WF + 1% Albedo	5	1	12.44	19.10	0.78	0.65	6.01	61.12
98% WF + 2% Albedo	6	2	11.98	19.99	0.79	0.81	5.81	60.71
97% WF + 3% Albedo	7	3	11.83	20.00	0.82	0.98	5.38	60.99
Corn flour group (CF)								
96% WF + 4% CF	8	4	11.75	19.25	0.77	0.47	5.99	67.76
94% WF + 6% CF	9	6	11.99	20.10	0.77	0.61	5.14	61.39
92% WF + 8% CF	10	8	11.93	20.13	0.79	0.66	5.00	61.49
Dry powdered beet root group BR)								
99% WF + 1% BR	11	1	12.01	19.87	0.79	0.48	5.13	61.72
98% WF + 2% BR	12	2	11.92	21.71	0.84	0.49	5.20	59.84
97% WF + 3 % BR	13	3	11.73	20.37	0.88	0.96	5.11	60.94

* Average of duplicate determination.

** Calculated by difference.

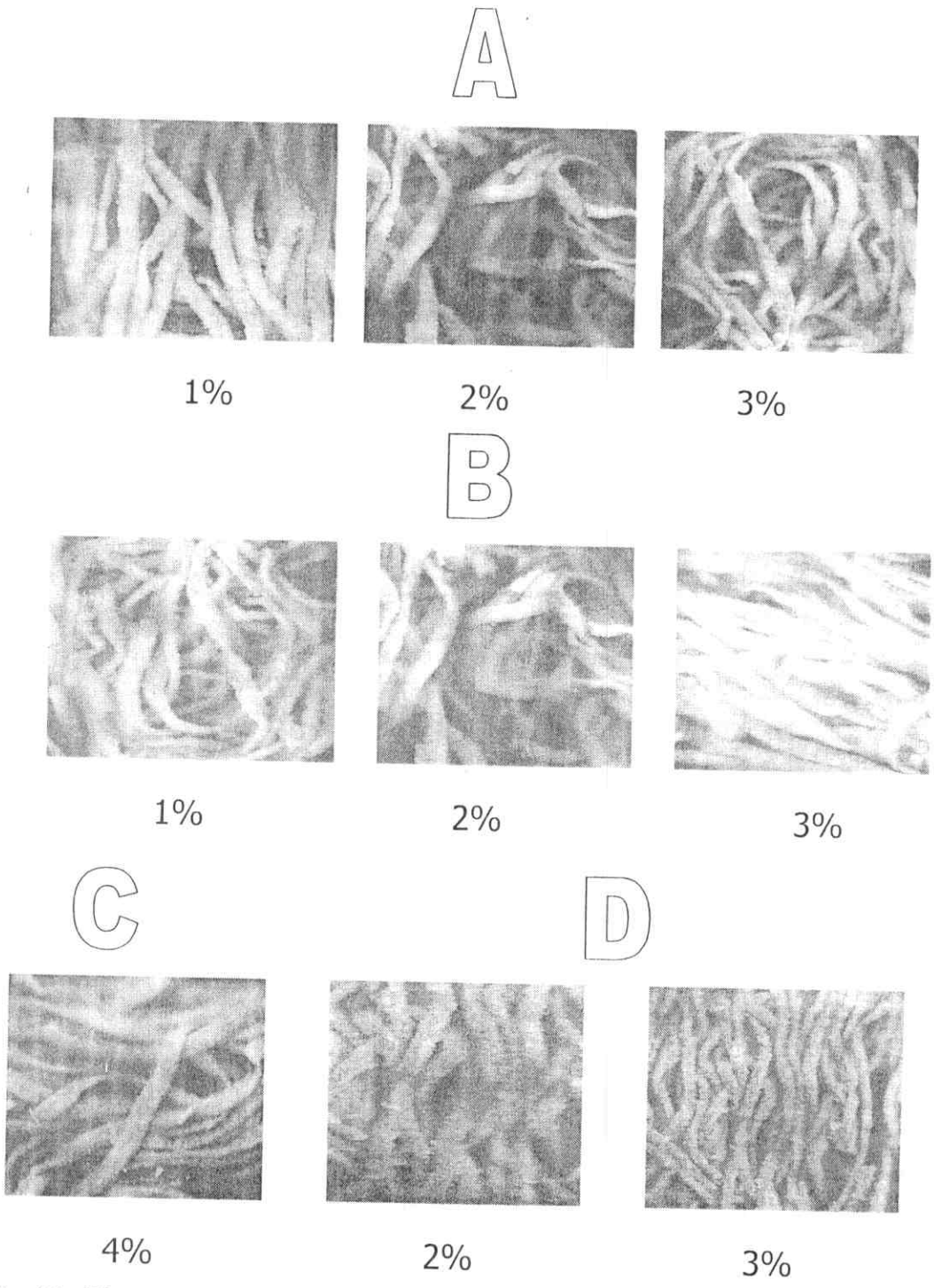


Fig. (4): Photographs for the instant noodles prepared during the preliminary study for screening some natural substitutes to 72% ext. wheat flour and their optimum levels of [A: Okara flour (OF); B: Dry orange albedo (ALPEDO); C: Corn flour and D: Rocket salad

4.2.2. Preliminary study on the appearance and cooking quality of experimental noodles:

Preliminary study on the cooking quality of the experimental instant noodles prepared from both wheat flours of 82% and 72% extraction rate only (controls) and those prepared from the four tested substitutes at the level of 1-3 % for OF, ALBEDO and BR or at the level of 4-8% CF are presented in Table 8 while their appearance is illustrated in the photographs appeared in figure 4.

Fried noodles prepared from 82% ext. WF groups showed lower weight and volume gain but higher cooking loss compared to their corresponding noodles prepared from 72% ext. WF groups. Data for weight and volume gain and cooking loss of fried noodles prepared from each kind of the substitutes tested did not show any remarkable difference, probably because of the low levels of substitution utilized. The slight increase in weight and volume gain observed with the sample no.10 was probably due the higher level of substitution (8% CF)

Therefore, it was decided to increase the level of substitution of okara flour, Albedo and beet roots to more than tested 3% level and , also, to increase the level of substitution of corn flour more than 8% in noodle wheat doughs prepared in the future. Furthermore, it was decided to test the possibility of using wheat flour of 65% extraction rate for the processing of instant noodles. Subsequently, the three WF of different extraction rates (82%, 72 % and 65 % ext.) were substituted by okara flour at levels of 10, 15, and 20% ; dry powdered orange albedo (ALBEDO) at levels of 5, 10, and 15% ; corn flour at levels of 10, 20, and 30% ; dry powdered beet roots at levels of 4, 6, and 8% were investigated for

Table (8): Preliminary study on the cooking quality properties of fried instant noodles prepared from wheat flours (82%, 72%, extractions) substituted by different levels of okara dry flour (OF) , dry powdered orange Albedo (ALBEDO), corn flour (CF) and dry powdered beet root (BR).

Experimental blends used to prepare noodles (%)	Cooking quality properties							
	Wheat flour (82% extraction)				Wheat flour (72% extraction)			
	Sample No.	Weight gain	Volume gain	Cooking loss	Sample No.	Weight gain	Volume gain	Cooking loos
Control group (WF)								
Wheat flour 82% ext.	1	181	186	7.8	14	183	190	6.72
Okara flour group (OF)								
99% WF + 1% OF								
98% WF + 2% OF	2	181	186	7.8	15	183	190.5	6.72
97% WF + 3% OF	3	182	186.5	7.83	16	184	191	6.74
	4	183	187	7.86	17	185	192	6.76
Dry powdered orange albedo group (ALBEDO)								
99% WF + 1% ALBEDO	5	182	187	7.8	18	183	190	6.75
98% WF + 2% ALBEDO	6	183	188	7.81	19	184	192	6.76
97% WF + 3% ALBEDO	7	184	189	7.82	20	185	194	6.79
Corn flour group (CF)								
96% WF + 4% CF								
94% WF + 6% CF	8	183	188	8.00	21	184	192	6.82
92% WF + 8% CF	9	185	190	8.4	22	186	194	6.99
	10	186	191	8.6	23	187	196	7.1
Dry powdered beet root group (BR)								
99% WF + 1% BR	11	181	186	7.82	24	183	190	6.7
98% WF + 2% BR	12	181.5	186.5	7.83	25	184	191	6.72
97% WF + 3 % BR	13	182	187	7.85	26	185	191.5	6.74

their suitability to produce noodles of acceptable appearance, chemical characteristics, cooking properties and quality parameters.

4.3. Study of the effect of wheat flour extraction rate , kind and substitution level of some natural products on rhelogical properties of doughs of the experimental instant noodles:

4.3.1. Brabendar farinograph dough properties:

The Farinograph records the changes in the physical nature of the dough during mixing over a certain period. Brabendor farinogharaph properties investigated included the determination of water absorption capacity (WA%), dough mixing time (M.T), dough development time (Dev.T.), dough stability time (Sta.T.) and degree of weakening (D.W) which are some of the most important readings deduced from the farinograph curves.

4.3.1.1. Effect of variation in extraction rate of wheat flours on farinorgraph properties of noodles doughs:

The effect of using wheat flours of different extraction rates (82%, 72 % and 65 % ext.) used in the preparation of instant noodles on the rheological properties of their dough's are presented in Tables (9, 10 and 11). It appeared that doughs of 65% extraction WF absorbed less water than those of 72% extraction and 82% extraction.

All dough farinograph parameters were influenced by variation in rate of extraction of wheat flour used in preparing doughs of instant WF noodles. Water absorption was higher in 82% WF doughs (62.6%)than doughs of 72% (59.4%) and WF doughs of 65% ext.(54.2%).

Table (9): Farinograph properties of doughs used to prepare instant noodles from 82% extraction wheat flour (WF) substituted by different levels of okara dry flour (OF), dry powdered orange albedo layer (ALBEDO), corn flour (CF) and dry powdered beet roots (BR).

Dough mixture	Farinoghaph properties					
	Sample No.	W.A.[1] (%)	M.T.[2] (min.)	Dev.T.[3] (min.)	Sta.T.[4] (min.)	D.W.[5] (B.U.)[6]
Control group (WF)						
Wheat flour of 82% extraction	1	62.6	1.5	3	15	20
Okara dry flour group (OF)						
90% WF + 10% OF	2	65.6	2.5	5.5	10.5	40
85% WF + 15% OF	3	71.3	3.5	8	9.5	50
80% WF + 20% OF	4	87.4	5	11	8	60
Dry powdered orange albedo group (ALBEDO)						
95% WF + 5% ALBEDO	5	75.00	5	8	12.5	30
90% WF + 10% ALBEDO	6	77.7	6.5	9	9	55
85% WF + 15% ALBEDO	7	83.5	7.5	12	7.5	70
Corn flour group (CF)						
90% WF + 10% CF	8	63.3	2	3.5	2.5	110
80% WF + 20% CF	9	62.9	3	4.5	2	120
70% WF + 30% CF	10	62.5	4	6	1.5	125
Dry powdered beet roots (BR)						
96% WF + 4% BR	11	65.8	2	3.5	6	80
94% WF + 6% BR	12	68.8	3	5	5	85
92% WF + 8% BR	13	72.1	3.5	6.5	4	90

1- W.A. : Water absorption.
2- M.T. : Mixing time.
3- Dev.T. : Development time.
4- Sta.T. : Stability time.
5- D.W. : Degree of weakening.
6- (B.U.) : Brabender unit.

Table(10):Farinograph properties of doughs used to prepare instant noodles from 72% extraction wheat flour (WF) substituted by different levels of okara dry flour (OF), dry powdered orange albedo layer (ALBEDO), corn flour (CF) and dry powdered beet roots (BR).

Dough mixture	Farinoghaph properties					
	Sample No.	W.A.[1] (%)	M.T.[2] (min.)	Dev.T.[3] (min.)	Sta.t.[4] (min.)	D.W.[5] (B.U.)[6]
Control group (WF)						
Wheat flour of 72% extraction	1	59.4	1.0	2.5	16.5	15
Okara flour group (OF)						
90% WF + 10% OF	2	63.1	1.5	5.0	13.0	30
85% WF + 15% OF	3	66.7	1.5	7.0	11.00	40
80% WF + 20% OF	4	86.6	3.5	10.0	10.00	45
Dry powdered orange albedo group (ALBEDO)		71.9	4.0	7.5	14.0	20
95% WF + 5% albedo	5	73.2	5.5	8.0	10.0	35
90% WF + 10% albedo	6	79.5	6.5	11.0	8.0	50
85% WF + 15% albedo	7					
Corn flour group (CF)						
90% WF + 10% CF	8	60.3	1.5	2.5	5.0	95
80% WF + 20% CF	9	59.9	2.0	3.5	4.0	100
70% WF + 30% CF	10	59.5	3.0	4.0	3.5	110
Dry powdered beet roots (BR)						
96% WF + 4% BR	11	61.5	1.5	2.5	8	70
94% WF + 6% BR	12	64.3	2.0	3.0	7.0	85
92% WF + 8% BR	13	67.4	2.5	4.5	6.0	90

2- W.A. : Water absorption.
2- M.T. : Mixing time.
4- Dev.T. : Development time.
4- Sta.T. : Stability time.
6- D.W. : Degree of weakening.
6- (B.U.) : Brabender unit.

Table (11): Farinograph properties of doughs used to prepare instant noodles from wheat flour (WF) of 65% extraction when substituted by different levels of okara dry flour (OF), dry powdered orange albedo layer (ALBEDO), corn flour (CF) and dry powdered beet roots (BR).

Dough mixture	Farinoghaph properties					
	Sample No.	W.A. (%)	M.T.[2] (min.)	Dev.T.[3] (min.)	Sta.t.[4] (min.)	D.W.[5] (B.U.)[6]
Control group (WF)						
Wheat flour of 65% extraction	1	54.2	1	1.5	17.5	10
Okara dry flour group (OF)						
90% WF + 10% OF	2	59.3	1	4	14	25
85% WF + 15% OF	3	62.7	1	5.5	12.5	35
80% WF + 20% OF	4	64.5	1.5	7.5	11	40
Dry powdered orange albedo group (ALBEDO)						
95% WF + 5% albedo	5	69	2.5	6	15	20
90% WF + 10% albedo	6	71.1	3.5	5.5	11	35
85% WF + 15% albedo	7	74.4	5	8	8.5	50
Corn flour group (CF)						
90% WF + 10% CF	8	57.3	1	1.5	6	80
80% WF + 20% CF	9	56.9	1.5	2.5	4.5	95
70% WF + 30% CF	10	56.5	2	3	4	110
Dry powdered beet roots (BR)						
96% WF + 4% BR	11	57.8	1	2	9	60
94% WF + 6% BR	12	60.4	2	3	8	70
92% WF + 8% BR	13	63.4	3.5	5	6.5	85

1- W.A. : Water absorption. **2- M.T.** : Mixing time.
3- Dev.T. : Development time. **4- Sta.T.** : Stability time.
5- D.W. : Degree of weakening. **6- (B.U.)** : Brabender unit.

Mixing time and dough development time lasted longer in WF doughs of 82% extraction (1.5 and 3 min.) than WF doughs of 72% (1.0 and 2.5 min.) and 65% extraction (1.0 and 1.5 min). Values for degree of weakening in 82% ext. WF dough were higher than in that of 72%ext ,while the 65% ext. WF dough showed the lowest value. In contrast, dough stability decreased in dough of WF of 82% ext. (15 min.)compared to 72% ext. WF dough (16.5 min.), and 65% ext. WF doughs (17.5min.)

The observed decrease could be attributed to the results founded in the present study (table 6) as well as other literature reports that crude fiber in wheat flour 82% of extraction is higher than that present of wheat flour of 72% and 65% ext. The presence of high fiber content was reported to cause an increase in the water absorption of dough which could be explained as a results of higher water hydration capacity of fibers **(Dougherty *et al*; 1988; Skurray *et al*;1988 and Abd-El-Moniem and Yassen; 1993)**.

4.3.1.2. Effect of kind of natural substitutes on farinograph properties of noodles doughs from wheat flours of different extraction rate:

Data on the effect of substitution of wheat flours of different extraction rates (82%, 72 % and 65 % ext.) by okara flour (OF), dry powdered orange peels albedo (ALBEDO), corn flour (CF) , and dry powdered beet roots (BR) on the rheological properties of instant noodles dough's are presented in Tables (9,10 and 11).

The substitution of wheat flours by different kinds of substitutes or the variation in kind of natural substitutes tested (OF,ALBEDO, CF and BR) influenced the dough farinograph properties of their noodle doughs.

From data obtained, it appeared that the variation in the kind of natural substitutes tested (OF, ALBEDO , CF and BR) resulted in an increase in water absorption, mixing time, development time and degree of weakening but also in a decrease in dough stability time . In addition ,the substitution of wheat flours by each kinds of substitute, regardless of the tested level of substitution (up to 20 % in OF, up to 15% ALBEDP ; up to 30% CF and up to 8% BR), increased the water absorption, mixing time, development time and degree of weakening, but stability time were decreased

In agreement to the obtained results , **Abo El-Naga (1995)** found that substitution of different sources of fibers in Egyptian pasta products increased the water absorption, dough development time and weakening while it reduced the dough stability as compared with control made of 100% whole durum meal.

4.3.1.3.Effect of level of substitution of different natural substitutes on fainograph properties of noodles doughs from wheat flours of different extraction rates:

Data on the effect of substitution of wheat flours of different extraction rates (82%, 72 % and 65 % ext.) by different levels of okara flour (OF), dry powdered orange peels albedo (ALBEDO), corn flour (CF) , and dry powdered beet roots (BR) on the farinograph rheological properties of instant noodles dough's are presented in Tables (9,10 and 11).

A. Okara flour (OF):

The substitution of wheat flours by okara flour at level of 10, 15 and 20% led to increase water absorption which reached 65.6, 71.3 and 87.4 for the 82 % ext. dough group, respectively ,

63.1, 66.7 and 86.6 for the 72% ext. dough group, respectively, and 59.3 , 62.7and 64.5% for the 65% ext. dough group, respectively, compared with the 82 ,72 and 65% ext. WF control dough's (62.6, 59.4 and 54.2%, respectively). Similarly, the mixing time were increased (2.5, 3.5 and 5 min. for the 82% ext dough, respectively; 1.5, 1.5 and 3.5 min. for the 72% ext. dough group, respectively, and 1, 1 and 1.5 min. for the 65% ext. dough group, respectively) compared to the corresponding 82,72 and 65 % ext. WF control dough's.

In a similar manner, the substitution of 10, 15 and 20% okara flour resulted in an increase in dough development time which recorded 5.5, 8 and 11 min. in the 82 % ext. dough group, respectively , and 5 , 7 and10 min in the 72% ext. dough group, respectively, and 4, 5.5 and 7.5 min. in for the 65 % ext. dough group, respectively) compared with the corresponding three 82, 72 and 65 % ext. WF dough controls (3, 2.5 and 1.5 min. , respectively).

Similarly, degree of dough weakening increased which recorded (40, 50 and 60 B.U. for the 82% ext. dough group, respectively , 30, 40 and 45 B.U for the 72 % ext. dough group, respectively., and 40, 35., and 25 B.U. for the 65 % ext. dough group, respectively) compared with corresponding three 82, 72 and 65 % ext. WF dough controls (20, 15, and 10 B.U,. respectively).

In contrast , the dough stability time decreased which recorded (10.5, 9.5, and 8 min. in the 82% ext. dough group, respectively ; 13, 11, and 10 min. in the 72% ext. dough group, respectively, and 14, 12.5, and 11 min. in the 65 % ext. dough

group, respectively) compared with corresponding three 82, 72 and 65 % ext. WF dough controls (15, 16.5, and 17.5 min.).

The obtained results were in agreement with those reported by **Yaseen, (1995) and Hafez (1996)** in Egypt.

B. Dry powdered orange albedo (ALBEDO).

Data from the same tables showed that substitution of WF by dry powdered orange albedo (ALBEDO) at level of 5, 10, and 15% led to an increase in water absorption which recorded 75, 77.7and 83.5% for the 82 % ext. dough group, respectively ; 71.9, 73.2, and 79.5; for the 72 % ext. dough group, respectively; and 69, 71.1, and 74.4 for the 65 % ext. dough group, respectively, compared with the 82 ,72 and 65% ext. WF control dough's (62.6, 59.4, and 54.2%,respectively)

Similarly , mixing time increased which reached 5, 6.5 and 7.5 min. in the 82 % ext. dough group, respectively; and 4 ,5.5 and 6.5 min. in the 72 % ext. dough group, respectively ; and 2.5 , 3.5 and 5 min in the 65 % ext. dough group, respectively.

In a consistent mode of increase, degree of dough weakening increased (30, 55 and 70 B.U. for the 82% ext. dough group, respectively , 20, 35and 50 B.U for the 72 % ext. dough group, respectively., and 19, 33., and 45 B.U. for the 65 % ext. dough group, respectively) compared with corresponding three 82, 72 and 65 % ext. WF dough controls (20, 15, and 10 B.U,. respectively).

In contrast , the dough stability time decreased which recorded (12.5, 9 and 7.5 min. in the 82% ext. dough group, respectively ; 14,10 and 8.0 min. in the 72% ext. dough group, respectively, and 15,11 and 8.5 min. in the 65 % ext. dough group,

respectively) compared with corresponding three 82, 72 and 65 % ext. WF dough controls (15, 16.5 and 17.5 min.).

These results were confirmed by those obtained by **Abu El-Maati (1999)** who found that substitution of 5% orange albedo layer for wheat bread doughs increased water absorption, mixing time, and development time. The obtained findings may be due to the high fiber content, which acts as a stabilizer in the dough system. Also, these results are in agreement with those obtained by **Abd- El Rahim *et al.* (1997)** who found that the substitution of flour by fibers increased water absorption, and mixing time of doughs.

C. Corn flour(CF)

Data from the same tables showed that substitution of WF by corn flour at level of 10, 20 and 30% led to an increase in water absorption which recorded 63 , 62.9 and 62.5 for the 82 % ext. dough group, respectively; 60.0, 95.9, and 95.5; for the 72 % ext. dough group, respectively 57, 56.9 and 56.5 for the 65 % ext. dough group, respectively. compared with the 82 ,72 and 65% ext. WF control dough's controls (62.6, 59.4 and 54.2% ,respectively) Similarly , mixing time increased which reached (3.5, 4.5 and 6min. in the 82 % ext. dough group, respectively; 1.5, 2, and 3 min. in the 72 % ext. dough group, respectively ; and 1, 1.5 and 2 min. in the 65 % ext. dough group, respectively) compared with corresponding three 82, 72 and 65 % ext. controls (1.5, 1 and 1 min. respectively).

In addition, degree of weakening also increased which were 110, 120 and 125 B.U. for the 82% ext. dough group; 95, 100 and 110 B.U. for the 72% ext. dough group ; and 80, 95 and 100 B.U. for the 65% ext. dough group) compared with corresponding three

82, 72 and 65 % ext. WF dough controls (20, 15 and 10 B.U. respectively).

In contrast, the substitution of corn flour at level 10, 20 and 30% flours resulted in a decrease in stability time which recorded (2.5, 2 and 1.5 min in the 82 % ext. dough group, respectively; 3.5, 4 and 3.5 min. in the 72 % ext. dough group, respectively, and 6, 4.5 and 4 min. in the 65 % ext. dough group, respectively) compared with corresponding thre82, 72 and 65% ext. WF dough controls (15, 16.5 and 17.5 min, respectively).

These obtained results were in agreement with those obtained by **Abou- Raya (1980)** and **Hussein *et al.* (1996).**

D. Dry powdered beet roots (BR):

Results presented in the same tables indicated that the substitution of WF doughs by dry powdered beet roots at level of 4, 6 and 8% increased water absorption 65.8, 68.8 and 72.1 for the 82 % ext. dough group, respectively; 61.5, 64.3 and 67.4 ; for the 72 % ext. dough group, respectively 57.8, 60.4 and 63.4 for the 65 % ext. dough group, respectively. compared with the 82 ,72 and 65% ext. WF control dough's controls (62.6, 59.4 and 54.2% ,respectively) Similarly , mixing time increased which reached (2, 3, and 4.5 min. . in the 82 % ext. dough group, respectively; 1.5, 2, and 2.5 min. in the 72 % ext. dough group, respectively ; and 1, 2 and 3.5 min. in the 65 % ext. dough group, respectively) compared with corresponding three 82, 72 and 65 % ext. controls (1.5, 1 and 1 min. respectively).

In addition, degree of weakening also increased which were 80, 85 and 90 B.U. for the 82% ext. dough group; 70, 85 and 90 B.U. for the 72% ext. dough group ; and 60, 70 and 85 B.U. for the

65% ext. dough group) compared with corresponding three 82, 72 and 65 % ext. WF dough controls (20, 15 and 10 B.U. respectively).

In contrast , the dough stability time decreased which recorded (6 , 5 and 4 min. in the 82% ext. dough group, respectively ; 8, 7 and 6 min. in the 72% ext. dough group, respectively, and 9, 8 and 6.5 min. in the 65 % ext. dough group, respectively) compared with corresponding three 82, 72 and 65 % ext. WF dough controls (15, 16.5, and 17.5 min. respectively). Dough stability was decreased further as substitution level was increased to 8% in dough.

The observed higher value for water absorption in the substituted doughs than those for the control WF doughs , regardless of kind of substitution, as well as the high water absorption with the increase in substitution level could be attributed to following reasons:

A) The increase in protein content, or substances that are rich in protein , as in the case of okara dough ,which in turn helps in increasing the absorption of water, and **B)** The increase in fibers, as in the case dry powdered beet roots and orange albedo which led to more water absorptin substituted and corn flour. These finding are in general agreement to those of **Dougherty *et al.*, 1988; Skurray et al. 1988 and Abd-El-Moniem and Yassen, 1993**.

Generally speaking, results indicated that the substitution of WF doughs of all the tested substitutes increased water absorption, mixing time, development time and degree of weakening but deceased dough stability time compared to their corresponding control wheat doughs.

In general, dough stability decreased with the inclusion of all the tested substitutes ,however ,the rate of such decrease was higher with the increase in substitution levels of okara flour, dry powdered albedo, corn flour, and dry powdered beet roots. In other words, the rate of such decrease in dough stability was found to reversibly related to increase in substitution level of substituted material in doughs. These results were found to be in agreement with those of **Armera and collar (1996)** and **Strachen, (2002)**

4.3.2. Brabendar Extensograph dough properties:

The investigated extensograph dough parameters included the measurement of dough extensibility (min.) , dough resistance to extension (B.U.) , dough proportional number and dough energy (cm^2.).

3.3.2.1.Effect of variation in extraction rate of wheat flours on extensograph properties of noodles doughs:

The effect of using wheat flours of different extraction rates (82%,72 % and 65 % ext.) in the preparation of experimental instant noodles on the rheological properties of their dough's are presented in Tables 12,13 and 14.

All dough extensograph parameters were influenced by variation in rate of extraction of WF used in preparing doughs of instant noodles. The 82% ext. WF doughs showed the lowest values in dough extensibility, dough resistance to extension, dough proportional number and dough energy ,while the 65% WF dough showed the highest values These findings are in general accordance to those reported by **Foda *et al.* (1997) and Fahied (1992)**for rheological properties of wheat flours.

4.3.2.2. Effect of kind of natural substitutes on extensograph properties of noodles doughs from wheat flours of different extraction rates:

The effect of substitution of wheat flours of different extraction rates (82%, 72 % and 65 % ext.) by okara flour (OF), dry powdered orange peels albedo (ALBEDO), corn flour (CF) , and dry powdered beet roots (BR) on the extesograph rheological properties of instant noodles dough's are presented in Tables (12, 13 and 14). The substitution of WF doughs by okara flour or corn flour or beet roots ,regardless of the substitution level and also extraction rate of WF utilized in making doughs, decreased dough extensibility, dough resistance to extension and dough energy ,but proportional number was increased compared to their corresponding WF control doughs . However, the only exception for these finding occurred in the 8%BR dough with the reading of dough resistance to extension , where in the 72 and 65% WF + 8%BR dough groups, the readings were higher than their corresponding WF control doughs .

On the other hand, the substitution of WF doughs by dry powdered orange albedo caused a decrease in all the measured extensograph dough parameters, regardless of the substitution level and also extraction rate of WF utilized in making doughs.

Table (12): Extensograph properties of doughs used to prepare instant noodles from 82% extraction wheat flour (WF) substituted by different levels of okara dry flour (OF), dry orange albedo layer (ALBEDO), corn flour (CF) and dry powdered beet roots (BR).

Dough mixture	Sample No.	Extensograph properties				
		Substitution Level (%)	Res. to Ext.[1] (B.U.)[2]	Extensibility	P.N.[3]	Energy (cm^2)
Control group (WF) Wheat flour of 82% extraction	1	100	560	160	3.5	100
Okara flour group (OF)						
90% WF + 10% OF	2	10	440	80	5.5	48
85% WF + 15% OF	3	15	500	70	7.1	43
80% WF + 20% OF	4	20	520	60	8.7	39
Dry powdered orange albedo group (ALBEDO)						
95% WF + 5% Albedo	5	5	65	70	0.9	44
90% WF + 10% Albedo	6	10	70	65	1.1	32
85% WF + 15% Albedo	7	15	76	50	1.5	14
Corn flour group (CF)						
90% WF + 10% CF	8	10	460	90	5.1	61
80% WF + 20% CF	9	20	360	85	4.2	47
70% WF + 30% CF	10	30	320	80	4.0	34
Dry powdered beet roots (BR)						
90% WF + 4% BR	11	4	450	85	5.3	60
94% WF + 6% BR	12	6	500	75	6.7	56
92% WF + 8% BR	13	8	560	55	10.2	51

1- Res. to Ext.: Resistance to extension.
2- B.U. : Brabendar unit.
3- P.N. : Proportional number

Table (13): Extensograph properties of doughs used to prepare instant noodles from 72% extraction wheat flour (WF) substituted by different levels of okara dry flour (OF), dry orange albedo layer (ALBEDO), corn flour (CF) and dry powdered beet roots (BR).

Dough mixture	Sample No.	Extensograph properties				
		Substitution Level (%)	Res. to Ext.[1] (B.U.)[2]	Extensibility	P.N.[3]	Energy (cm^2)
Control group (WF) Wheat flour of 72% extraction	1	100	780	180	4.3	120
Okara dry flour group (OF)						
90% WF + 10% OF	2	10	600	90	6.7	60
85% WF + 15% OF	3	15	700	80	8.8	54
80% WF + 20% OF	4	20	720	70	10.3	44
Dry powdered orange albedo group (ALBEDO)						
95% WF + 5% Albedo	5	5	90	80	1.1	60
90% WF + 10% Albedo	6	10	95	75	1.3	45
85% WF + 15% Albedo	7	15	105	60	1.8	20
Corn flour group (CF)						
90% WF + 10% CF	8	10	640	100	6.4	70
80% WF + 20% CF	9	20	500	95	5.3	55
70% WF + 30% CF	10	30	440	90	4.9	40
Dry powdered beet roots (BR)						
90% WF + 4% BR	11	4	640	95	6.7	70
94% WF + 6% BR	12	6	700	85	8.2	66
92% WF + 8% BR	13	8	800	60	13.3	60

1- **Res. to Ext.:** Resistance to extension.
2- **B.U.** : Brabender unit.
3- **P.N.** : Proportional number.

Table (14): Extensograph properties of doughs used to prepare instant noodles from 65% extraction wheat flour (WF) substituted by different levels of okara dry flour (OF), dry orange albedo layer (ALBEDO), corn flour (CF) and dry powdered beet roots (BR).

Dough mixture	Sample No.	Extensograph properties				
		Substitution Level (%)	Res. to Ext.[1] (B.U.)[2]	Extensibility (mm)	P.N.[3]	Energy (cm^2)
Control group (WF)						
Wheat flour of 65% extraction	1	100	900	190	4.7	132
Okara flour group (OF)						
90% WF + 10% OF	2	10	710	100	7.1	64
85% WF + 15% OF	3	15	800	90	8.9	61
80% WF + 20% OF	4	20	840	80	10.5	47
Dry powdered orange albedo group (ALBEDO)						
95% WF + 5% Albedo	5	5	110	90	1.2	66
90% WF + 10% Albedo	6	10	130	80	1.6	50
85% WF + 15% Albedo	7	15	140	70	2.0	24
Corn flour group (CF)						
90% WF + 10% CF	8	10	740	110	6.7	80
80% WF + 20% CF	9	20	600	100	6.0	61
70% WF + 30% CF	10	30	500	95	5.3	45
Dry beet roots (BR)						
90% WF + 4% BR	11	4	710	100	7.1	78
94% WF + 6% BR	12	6	810	90	9.0	73
92% WF + 8% BR	13	8	920	70	13.1	67

1- **Res. to Ext .:** Resistance to extension.
2- **B.U.** : Brabender unit
3- **P.N.** : Proportional number.

4.3.2.3. Effect of level of substitution of different natural substitutes on Extensograph properties of noodles doughs from wheat flours of different extraction rates:

Tables (12, 13, and 14) showed that extensograph paramenters of WF doughs (82%, 72%, and 65% extraction)and their corresponding doughs substituted by the four kinds of natural products and as affected by variation in substitution levels; 10, 15, and 20% of okara flour; 5, 10, and 15% of dry powdered orange albedo; 10, 20, and 30% of corn flour; and 4, 6, and 8% dry powdered beet roots.

A. Okara flour (OF):

The substitution of WF doughs by okara flour at levels 10, 15, and 20% decreased dough extensibility which recorded 80, 70 and 60 min. in the 82% ext. group, respectively ; 90, 80 and 70 min. in the 72% ext. group, respectively , and 100, 90 and 80 min in the 65% ext. group, respectively) compared with the corresponding 82 , 72 and 65% ext. WF control dough's (160, 180, and 190 min., respectively).

Similarly, resistance to extension decreased which reached 440, 500, and 520 B.U. in the 82% ext. group, respectively ; 600, 700, and 720 B.U. in the 72% ext. group, respectively ; and 710, 800, and 840 B.U. in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control dough's (560, 780, and 900 B.U. respectively).

In addition, values for dough energy decreased (48, 43, and 39 cm in the 82% ext. group, respectively ; 60, 54, and 44 cm^2. in the 72% ext. group , respectively; and 64, 61, and 47 cm^2 in the 65%

ext. group , respectively compared with the corresponding 82 , 72 and 65% ext. WF control dough's (100, 120, and 132 cm^2 respectively).

In contrast, values for the proportional number were increased (5.5, 7.1, and 8.7 in the 82% ext. group, respectively, 6.7 , 8.8, and 10.3 in the 72% ext. group, respectively; and 7.1, 8.9 and 10.5 the 65 % ext. group, respectively), compared with the corresponding 82 , 72 and 65% ext. WF control dough's (3.5, 4.3, and 4.7, respectively).

B. Dry powdered orange albedo (ALBEDO):

The substitution of WF doughs by dry powdered orange albedo at levels of 5, 10, and 15% 82, 72 and 65% extraction rates decreased dough extensibility which recorded 70, 65, and 50 min. in the 82% ext. group, respectively ; 80 ,75 and 60 min. in the 72% ext. group ,respectively ; and 90 mm., 80, and 70 min. in the 65% ext. group, respectively , compared with the corresponding 82 , 72 and 65% ext. WF control dough's (160, 180, and 190 mm., respectively).

In a similar manner, resistance to extension decreased to 65, 70, and 76 B.U. in the 82% ext. group, respectively ; 90, 95, and 105 B.U. in the 72% ext. group, respectively ; and 110, 130, and 140 B.U in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control dough's (560, 780, and 900 B.U. ,respectively).

Values for proportional number were lowered (0.9, 1.1, and 1.5 in the 82% ext. group, respectively ; 1.1, 1.3, and 1.8 in the 72% ext. group, respectively ; and 1.2, 1.6, and 2, in the 65% ext.

group, respectively) compared with the corresponding 82 , 72 and controls dough's (3.5, 4.3, and 4.7, respectively).

In addition , values for dough energy decreased to 44, 32, and 14 cm^2 in the 82% ext. group, respectively ; 60, 45, and 20 cm^2. in the 72% ext. group, respectively ; and 66, 50, and 24 $cm.^2$ in the 65 % ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext controls (100, 120, and 132 $cm.^2$,respectively).

The result were in accordance with those reported was **Abu-El- Maati (1999)** who indicated that the addition of 5% dry orange albedo decreased the extensibility. This may be due to the presence of appreciable amounts of crude fiber and pectin which give a strong and rigid dough .

C. Corn flour (CF)

The substitution of WF doughs by corn flour at levels of 10, 20, and 30% decreased dough extensibility which recorded 90, 85, and 80 min, in the 82% ext. group in the 72% ext. group, respectively; 100 , 95 and 90 min. in the 65% ext. group, respectively ; and 110, 100, and 95 min. in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control dough's (160, 180, and 190 mm, respectively).

Values for resistance to extension also decreased to 460, 360 and 320 B.U. in the 82% ext. group, respectively ; 640, 500, and 440 B.U. in the 72% ext. group, respectively ; and 740, 600, and 500 B.U in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control dough's (560, 780, and 900 B.U., respectively).

Values for proportional number were higher (5.1, 4.2, and 4 in the 82% ext. group, respectively ; 6.4, 5.3, and 4.9 in the 72%

ext. group, respectively ; and 6.7, 6, and 5.3 in the 65% ext. group, respectively) compared with the corresponding 82 , 72 and 65% ext. WF control dough's (3.5, 4.3, and 4.7 , respectively).

On the other hand, dough energy values decreased to 61, 47, and 34 cm^2. in the 82% ext. group, respectively ; 70, 55, and 40 cm^2. in the 72% ext. group, respectively ; and 80, 61, and 45 cm^2 in the 65% ext. group, respectively ,compared with the corresponding 82 , 72 and 65% ext. WF control dough's (100, 120 and 132 cm^2 , respectively).

These obtained results in the present investigation were in accordance with those reported by **El- Said and El-Farra (1981).**

D. Dry powdered beet roots

The substitution of WF doughs by BR at level of 4, 6, and 8% decreased dough extensibility which recorded 85, 75, and 55 min. in the 82% ext. group, respectively ; 95, 85, and 60 mi. in the 72% ext. group, respectively ; and 100, 90, and 70 min. in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control dough's (160, 180, and 190 min respectively).

Values for resistance to extension decreased to 450 and 500 B.U. in the 82% ext. group, respectively; 640 and 700 and B.U. in the 72% ext. group, respectively ; and 710 and 810 B.U. in the 65 % ext. group, respectively, compared with the 82 , 72 and 65% ext. WF control dough's (560, 780 and 900 B.U., respectively). It was interesting to note that the BR group showed different pattern **only** with the 8% substitution level group. First, with 82% ext .WF, there was no change the value of resistance to extension of the 8% BR dough sample (560 B.U.) of its corresponding 82% WF

dough control (560 B.U.).Secondly, with both 72 and 65% extraction WF groups, there was an increase in values for dough resistance to extension of the 8% BR dough samples (800 and 920 B.U. , respectively) compared with their corresponding 72 and 65 % ext. dough controls(780 and 900 B.U., respectively)

Values for proportional number were found higher (5.3, 6.7 and 10.2 in the 82% ext. group, respectively ; 6.7, 8.2 and 13.3 in the 72% ext. group, respectively ; and 7.1, 9 and 13.1 in the 65% ext. group, respectively) compared with the corresponding 82 , 72 and 65% ext. WF control dough's (3.5, 4.3, and 4.7 , respectively).

Values for dough energy decreased to 60, 56, and 51 cm^2. in the 82% ext. group, respectively; 70, 66, and 60 cm^2. in the 72% ext. group, respectively; and 78, 73 and 67 $cm.^2$ in the 65% ext. group, respectively) compared with the corresponding 82 , 72 and 65% ext. WF control dough's (100, 120, and 132 $cm.^2$, respectively).

4.4. Study of the effect of wheat flour extraction rate, kind and substitution level of some natural products on technological characteristics of the steamed instant noodles:

Based on results of the preliminary study (tables 2A, 6 ,7 and 8), it was decided to increase the substitution level of all natural substitutes to 5 ,10 ,15 and 20 % of okara flour (instead of 1,2,and 3 %) ; to 5,10 and 15 % of dry orange albedo (instead of 1,2 and 3) ; to 10,20 and 30 % of corn flour (instead of 4,6 and 8) ; and to 4, 6 and 8 % dry beet roots flour (instead of 1,2,and 3 %). Therefore, the aforementioned substitution levels of natural substitutes (table 2B)

will be applied in making experimental substituted noodles and , hence, compared to their corresponding WF noodles.

The changes occurring in firmness and color values as well as the cooking quality properties (weight gain volume gain and cooking loss) of noodles steamed for 2 to 3 min. were then fully investigated. Experimental noodles samples were prepared from WF of three extraction rates (82%, 72 % and 65 % ext.) as well as from WF substituted by the selected variable levels of the chosen natural substitutes.

4.4.1. Effect of variation in extraction rate of wheat flours on firmness, color and cooking quality properties of their steamed instant noodles:

The effect of steaming process on the firmness, color, and cooking quality properties of steamed noodle prepared from wheat flours of different extraction rates (82%,72 % and 65 % ext.)were studied and the obtained results are presented in tables 13, 14 and 15) .

The variation in extraction rate of wheat flours influenced the firmness and color values and also the cooking quality properties of their resultant steamed noodles. The 82 % ext WF group exhibited the highest values for firmness , color and cooking loss (0.18 kg/ cm^2 , 0.19 and 6.22 %, respectively)and the lowest values for weight gain and volume gain (181 and 186 % , respectively). The 65% ext. WF group exhibited the lowest values for firmness , color and cooking loss (0.15 kg / cm^2, 0.16 and 4.48%, respectively) and the highest values for weight gain and volume gain (186 and 195 % , respectively).

4.4.2. Effect of kind of natural substitutes on firmness, color and cooking quality properties of their steamed instant noodles.

The effect of substitution of wheat flours of different extraction rates (82, 72 and 65 % ext.) by okara (OF), orange albedo, corn flour, and beet roots (BR) on firmness, color and cooking quality properties of steamed instant noodles are presented in Tables (15, 16 and 17).

The inclusion of okara flour, orange albedo, corn flour and beet roots to wheat flour during the processing of steamed noodles influenced their firmness and color values and also their cooking quality properties. In general, regardless of the kind of natural substitute tested, firmness and color values as well as cooking quality parameters (weight gain, volume gain and cooking loss) were increased in their prepared steamed noodle samples compared to the corresponding 82 , 72 and 65% ext. wheat flour control steamed noodles.

4.4.3. Effect of variation in level of natural substitutes on firmness, color and cooking quality properties of steamed instant noodles :

Data on the effect of substitution of wheat flours of different extraction rates (82%, 72 % and 65 % ext.) by different levels of okara flour (5, 10,15 and 20% OF), orange albedo (5, 10 and 15%ALBEDO), corn flour (10, 20 and 30% CF) , and beet roots (4, 6, and 8% BR) on firmness, color and cooking quality properties of steamed instant noodles are presented in Tables (15, 16 and 17).

Table (15): Effect of steaming process on firmness, color and cooking quality of instant noodles prepared from 82% extraction wheat flour (WF) substituted by different levels of various additives.

Experimental blends used to prepare noodles (%)	Sample No.	Experimental steamed noodles samples*						
		Steaming time (min)	Firmness (kg/cm^2)**	Color	Moisture content (%)**	Cooking quality properties		
						Weight gain (%)	Volume gain (%)	Cooki loss (%)
Control group (WF)								
Wheat flour (82% extraction)	1	2-3	0.18	0.188	6.12	181	186	6.2
Okara flour group (OF)								
95% wheat flour + 5% OF	2	2-3	0.18	0.190	6.13	184	189	5.3
90% wheat flour + 10% OF	3	2-3	0.18	0.193	6.16	187	192	5.3
85% wheat flour + 15% OF	4	2-3	0.19	0.196	6.20	190	195	6.5
80% wheat flour + 20% OF	5	2-3	0.19	0.200	6.42	195	200	9.2
Dry powdered orange albedo group (ALBEDO)								
95% wheat flour + 5% albedo	6	2-3	0.19	0.189	6.89	186	190	6.7
90% wheat flour +10% albedo	7	2-3	0.20	0.189	6.79	190	195	7.7
85% wheat flour +15% albedo	8	2-3	0.21	0.19	6.05	200	200	11.(
Corn flour group (CF)								
90% wheat flour + 10% CF	9	2-3	0.15	0.200	6.10	186	192	15
80% wheat flour + 20% CF	10	2-3	0.16	0.211	6.10	189	196	16
70% wheat flour + 30% CF	11	2-3	0.17	0.216	6.5	210	215	19
Dry beet roots (BR)								
96% wheat flour + 4% BR	12	2-3	0.17	0.200	5.90	183	187	6.2
94% wheat flour + 6% BR	13	2-3	0.18	0.219	5.60	186	189	6.4
92% wheat flour + 8% BR	14	2-3	0.19	0.240	5.31	188	192	7.5

* As is basis. ** Average of duplicate determination.

(16): Effect of steaming process on firmness, color and cooking quality of instant noodles prepared from 72% extraction wheat flour (WF) substituted by different levels of various additives.

perimental blends used to prepare noodles (%)	Sample No.	Steaming time (min)	Experimental steamed noodles samples*					
			Firmness (kg/cm^2)**	color	Moisture content (%)**	Cooking quality properties		
						Weight gain (%)	Volume gain (%)	Cooking loss (%)
rol group (WF)								
it flour (72% extraction)	1	2-3	0.16	0.170	7.00	183	190	5.29
a flour group (OF)								
wheat flour + 5% OF	2	2-3	0.16	0.172	7.00	185	196	5.00
wheat flour + 10% OF	3	2-3	0.16	0.175	7.00	184	198	5.2
wheat flour + 15% OF	4	2-3	0.17	0.176	6.99	187	199	5.88
wheat flour + 20% OF	5	2-3	0.19	0.180	6.95	186	210	6.9
powdered orange albedo p (ALBEDO)								
wheat flour + 5% albedo	6	2-3	0.17	0.172	6.5	190	197	6.13
wheat flour +10% albedo	7	2-3	0.20	0.175	6.3	200	205	6.70
wheat flour +15% albedo	8	2-3	0.23	0.180	6.51	220	215	7.28
flour group (CF)								
wheat flour + 10% CF	9	2-3	0.13	0.188	6.62	188	188	10.02
wheat flour + 20% CF	10	2-3	0.14	0.194	6.53	195	195	11.00
wheat flour + 30% CF	11	2-3	0.16	0.198	6.42	230	230	11.55
powdered beet roots								
	12	2-3	0.17	0.200	6.2	184	194	5.78
wheat flour + 4% BR	13	2-3	0.17	0.218	6.12	187	196	5.80
wheat flour + 6% BR	14	2-3	0.18	0.220	6.00	189	198	5.90
wheat flour + 8% BR								

As is basis. ** Average of duplicate determination.

Table (17): Effect of steaming process on firmness, color and cooking quality of instant noodles prepared from 65% extraction wheat flour (WF) substituted different levels of various additives.

Experimental blends used to prepare noodles (%)	Sample No.	Steaming time (min)	Experimental steamed noodles samples*					
			Firmness (kg/cm^2)**	color	Moisture content (%)**	Cooking quality properties		
						Weight gain (%)	Volume gain (%)	Cookin loss (%)
Control group (WF)								
Wheat flour (65% extraction)	1	2-3	0.15	0.160	6.5	186	195	4.48
Okara flour group (OF)								
95% wheat flour + 5% OF	2	2-3	0.15	0.162	6.70	188	197	4.89
90% wheat flour + 10% OF	3	2-3	0.15	0.163	6.82	190	200	4.96
85% wheat flour + 15% OF	4	2-3	0.16	0.166	6.91	198	207	5.13
80% wheat flour + 20% OF	5	2-3	0.17	0.169	7.00	210	215	5.13
Dry powdered orange albedo group (ALBEDO)								
95% wheat flour + 5% albedo	6	2-3	0.16	0.161	5.11	210	199	4.172
90% wheat flour +10% albedo	7	2-3	0.18	0.163	5.15	230	220	4.175
85% wheat flour +15% albedo	8	2-3	0.19	0.165	5.20	256	230	5.180
Corn flour group (CF)								
90% wheat flour + 10% CF	9	2-3	0.13	0.161	6.23	190	199	6.17
80% wheat flour + 20% CF	10	2-3	0.15	0.165	6.30	198	210	7.20
70% wheat flour + 30% CF	11	2-3	0.17	0.167	5.68	240	245	8.50
Dry beet roots (BR)								
96% wheat flour + 4% BR	12	2-3	0.17	0.170	5.00	187	197	5.10
94% wheat flour + 6% BR	13	2-3	0.18	0.177	5.89	190	199	5.40
92% wheat flour + 8% BR	14	2-3	0.19	0.179	5.98	193	202	5.60

* As is basis. ** Average of duplicate determination.

A. Okara flour :

The substitution of wheat flours by okara flour at levels of 5,10, 15 and 20% resulted in firmness values of 0.18, 0.18, 0.19 and 0.19 kg / cm^2 in the 82% ext. group, respectively ; 0.16, 0.16, 0.16 and 0.19 kg / cm^2 in the 72% ext. group, respectively ; and 0.15, 0.15, 0.16 and 0.17 kg / cm^2 in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (0.18, 0.16, and 0.15 kg / cm^2 ,respectively). Firmness values did not show any change except with the 20% level OF in both 82 and 72%ext. groups as well as both the 15 and 20% levels with the 65% ext. group.

In another pattern, color values showed gradual increase with the inclusion of OF and also increasing the level of substitution which reached 0.190, 0.193, 0.196 and 0.200 in the 82% ext. group, respectively ; 0.172, 0.175, 0.176 and 0.180 in the 72% ext. group, respectively ; and 0.162, 0.163, 0.166 and 0.169 in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (0.188, 0.170 and 0.160 ,respectively).

Values for the cooking quality properties were increased by increasing the level of substitution, where weight gain values increased to 184, 187, 190 and 195 % in the 82% ext. group, respectively ; 185, 189, 194 and 200 % in the 72% ext. group, respectively ; 188, 190, 198 and 210 % in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (181, 183 and 186 %respectively). Similarly, volume gain were increased to 189, 192, 195 and 200 % in the 82% ext. group, respectively ; 196, 198, 199 and 205 % in the 72% ext. group, respectively ; and 197, 200, 207

and 215 % in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (186, 190 and 195 % ,respectively).

Subsequently, cooking loss values were increased by increasing the OF level of substitution (5.30, 5.35, 6.53 and 9.20 % in the 82% ext. group, respectively, 5, 5.2, 5.88 and 6.9 % in the 72% ext. group, respectively ; and 4.89, 4.96, 5.13 and 5.13 % in the 65% ext. group, respectively), compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (6.22, 5.29 and 4.48 % respectively,).

B. Dry powdered orange albedo (ALBEDO):

The inclusion and substitution of wheat flours by orange albedo flour at levels of 5,10 and 15 increased firmness values by increasing level of substitution where it reached 0.19, 0.20, and 0.21 kg / cm^2 in the 82% ext. group, respectively ; 0.17, 0.20, and 0.23kg / cm^2 in the 72% ext. group, respectively ; 0.16, 0.18, and 0.19 kg / cm^2 in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (0.18, 0.16, and 0.15 kg / cm^2 ,respectively).

Similarly, color values were increased 0.189, 0.189, and 0.19 in the 82% ext. group, respectively ; 0.172, 0.175, and 0.180 in the 72% ext. group, respectively ; and 0.161, 0.163, and 0.165 in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (0.188, 0.170 and 160 ,respectively).

In contrast, values for the cooking quality properties were increased by increasing level of substitution where weight gain reached in 186, 190, and 200 % in the 82% ext. group, respectively ;

ext. WF control steamed noodles (0.18, 0.16, and 0.15 kg / cm^2 , respectively). However, the only exception was observed at sample 4% BR in the 82% ext. group which showed lower firmness than its corresponding 82% control.

Similarly, color values were increased (0.200, 0.218, and 0.220 in the 82% ext. group, respectively ; 0.188, 0.194, and 0.198 in the 72% ext. group, respectively ;l and 0.170, 0.177, and 0.179 in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (0.188, 0.170 and 0.160 ,respectively).

Values for the cooking quality properties were increased by inclusion and increasing substitution level of BR where weight gain increased to 183, 186, and 188 % in the 82% ext. group, respectively ; 184, 187 and 190 % in the 72% ext. group, respectively ; and 187, 190 and193% in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (181, 183 and 186 % ,respectively).Volume gain were also increased (187, 189 and 192 % in the 82% ext. group, respectively ; 194, 196 and 198 % in the 72% ext. group, respectively ; and 197, 199 and 202 % in the 65% ext. group, respectively), compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (186, 190 and 195 %, respectively,)

Cooking loss values showed similar pattern of increase (6.22, 6.45 and 7.52 % in the 82% ext. group, respectively ; 5.78, 5.80 and 5.90 % in the 72% ext. group, respectively ; and 5.10, 5.40 and 5.60x % in the 65%ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (6.22, 5.29 and 4.48 % .respective

In general it was observed that , regardless of the increase in level of substitution for all the natural substitutes investigated, values for firmness , color and cooking quality of the steamed experimental noodles were increased. However, some firmness values behaved different, where they did not show any change with the 20% level OF in both 82 and 72%ext. groups as well as both the 15 and 20% levels OF with the 65% ext. group. In addition , sample 4% BR in the 82% ext. group which showed lower firmness than its corresponding 82% control.

From these obtained data it could be observed that firmness values of steamed noodles increased, regardless of extraction rate of starting flour and the kind of tested substitutes, with increasing the level of substitution. These findings could be attributed to the increase in water uptake during steaming which caused, in turn, in elevating of moisture content of uncooked noodles which leads to obtain noodle of soft structure, therefore firmness values increases with increasing the level of substitution in the noodles doughs.

From the previous results it could be concluded that steaming of noodles for about 2-3 min. resulted in the highest values for firmness and color and highest cooking quality properties for the steamed noodle products. Moreover, among noodles prepared with different substitutes, steamed noodles from 65% wheat flours extraction produced appeared to have the best desired properties for steamed noodles.

The obtained results confirmed those reported by **Singh *et al.* (1994),** who showed that the dough contained sufficient moisture during making to provide a good texture of the final product. They also reported that as the moisture content in final product increased firmness decreased.

From the tables 15, 16 and 17 it could be observed that values for color of steamed noodles increased with increasing the substitution level of natural materials. These results could be attributed to the presence of enzymatic browning products which normally increases during steaming process of noodles that contained more of water uptake through the steaming process. These results are in agreement with those obtained by **Mazza (1986)** and **Hsieh *et al.* (1990)** who mentioned that as moisture content of sample increased, the absorbance of extracted color from pasta increased.

From the obtained data , it could be noticed that the cooking loss of steamed noodles increased gradually during steaming of noodles with increasing extraction rate of wheat flours. This could be explained by the fact that starch granules are influenced by flour extraction process where they increased by decreasing the extractions rate of wheat flours, specially wheat flour of 65% extraction **(Moss *et al.*, 1997).**

4.5. Study of the effect of wheat flour extraction rate, kind and substitution level of some natural products on some technological characteristics of the fried instant noodles:

The changes occurring in the firmness and color values as well as the cooking quality properties of instant fried noodles were studied. Noodles prepared using okara, dry powdered orange albedo and corn flour were fried at 180 to 185C for 40 to 45 sec. ,while those prepared from dry powdered beet roots were fried and cooked at 170 C^{o} for 30-35 sec.

4.5.1. Effect of variation in extraction rate of wheat flours on firmness, color and cooking quality properties of fried instant noodles:

The effect of variation in extraction rate of wheat flours on some frying process properties such as firmness , color and cooking quality properties values of the resultant instant fried noodles were studied and the obtained results are presented in tables 18,19 and 20 and figs 5, 6, 7, 8 and 9).

The variation in extraction rate of wheat flours influenced the firmness and color values and also the cooking quality properties of their resultant fried noodles. The 82 % ext WF group exhibited the highest values for firmness, color and cooking loss (1.53 kg/ cm^2 , 0.18 and 7.8 %, respectively) and the lowest values for weight gain and volume gain (180 and 185 %, respectively). The 65% ext. WF group exhibited the lowest values for firmness , color and cooking loss (1.33 kg / cm^2, 0.13 and 5.33 %, respectively) and the highest values for weight gain and volume gain (183 and 193 % , respectively).

From these results it could be noticed that there were reversible or counter relation between values for firmness, color and cooking loss and rate of wheat flour extraction and also a proportional relation between weight gain and volume gain values and rate of wheat flour extraction.

The found coking quality parameters found for the experimental steamed noodles are in general agreement to those of Toyokawa et al. (1989a) reported that the most important characteristics of Japanese white salted noodles were the eating quality (noodle texture) followed by color, taste, surface appearance and weight and volume after cooking.

4.5.2. Effect of kind of natural substitutes on firmness, color and cooking quality properties of fried instant noodles:

The effect of substitution of wheat flours of different extraction rates (82%, 72 % and 65 % ext.) by okara flour (OF), orange albedo (ALBEDO), corn flour (CF) , and beet roots (BR) on firmness, color and cooking quality properties of fried instant noodles are presented in Tables 18,19 and 20 and illustrated in figs 5, 6, 7, 8 and 9).

The inclusion of okara flour, orange albedo, corn flour and beet roots to wheat flour during the processing of fried noodles influenced their firmness and color values and also their cooking quality properties. In general, regardless of the kind of natural substitute tested, firmness and color values as well as cooking quality parameters (weight gain, volume gain and cooking loss) were increased in their prepared fried noodle samples compared to the corresponding 82 , 72 and 65% ext. wheat flour control noodles.

4.5.3. Effect of level of natural substitutes on firmness, color and cooking quality properties of fried instant noodles:

Data on the effect of substitution of wheat flours of different extraction rates (82%, 72 % and 65 % ext.) by different levels of okara flour (5,10,15 and 20 %OF), orange albedo (5, 10 and 15 % ALBEDO), corn flour (10, 20 and 30 % CF) , and 4,6 and 8 % beet roots (BR) on firmness, color and cooking quality properties of fried instant noodles are presented in Tables 20 ,21 and 22 and figs 5, 6, 7, 8 and 9 .

Table (18): Effect of frying process on the firmness, color and lipid content of instant noodles prepared from 82% extraction wheat flour substituted by different levels of various additives. **

Experimental to Blends used to prepare noodles (%)	Sample No.	Steaming time (min)	Experimental fried noodles samples*						
			Temp. frying (c)°	Time (sec)	Firmness (kg/cm²)**	Color	Cooking quality properties		
							Weight gain (%)	Volume gain (%)	Cooking loss (%)
Control group (WF)									
Wheat flour of 82% extraction.	1	2-3	180-185	40.45	1.53	0.185	180	185	7.8
Okara flour group (OF)									
95% WF + 5% OF	2	2-3	180-185	40-45	1.56	0.205	185	188	7.9
90% WF + 10% OF	3	2-3	180-185	40-45	1.60	0.225	188	192	8.1
85% WF + 15% OF	4	2-3	180-185	40-45	1.67	0.239	193	195	8.3
80% WF + 20% OF	5	2-3	180-185	40-45	1.84	0.267	197	200	8.6
Dry orange albedo group (ALBEDO)									
95% WF + 5% Albedo	6	2-3	180-185	40-45	2.07	0.198	187	190	8.0
90% WF + 10% Albedo	7	2-3	180-185	40-45	2.19	0.199	190	194	8.5
85% WF + 15% Albedo	8	2-3	180-185	40-45	2.39	0.200	200	210	9.0
Corn flour group (CF)									
90% WF + 10% CF	9	2-3	180-185	40-45	1.80	0.190	188	193	8.9
80% WF + 20% CF	10	2-3	180-185	40-45	1.86	0.195	195	200	9.2
70% WF + 30% CF	11	2-3	180-185	40-45	1.90	0.199	208	215	9.8
Dry powdered beet roots group (BR)									
96% WF + 4% BR	12	2-3	170	30-35	1.23	0.253	183	188	7.9
94% WF + 6% BR	13	2-3	170	30-35	1.27	0.268	186	190	8.0
92% WF + 8 % BR	14	2-3	170	30-35	1.31	0.371	189	192	8.2

* As is basis.

** Average of duplicate determination.

'able (19): Effect of frying process on the firmness, color, moisture and lipid content of instant noodles prepared from 72% extraction wheat flour substituted by different levels of various additives.

ɔerimental blends ısed to prepare noodles (%)	Sample No.	Steaming time (min	Experimental fried noodles samples*						
			Temp. frying (c)°	Time (sec)	Firmness (kg/cm²)**	Color	Cooking quality properties		
							Weight gain (%)	Volume gain (%)	Cooking loss (%)
trol group (WF)									
at flour 72% ext.	1	2-3	180-185	40-45	1.44	0.155	181	188	6.72
ra flour group (OF)									
WF + 5% OF	2	2-3	180-185	40-45	1.50	0.160	186	194	7.00
WF + 10% OF	3	2-3	180-185	40-45	1.54	0.180	190	199	7.21
WF + 15% OF	4	2-3	180-185	40-45	1.59	0.193	196	200	7.75
WF + 20% OF	5	2-3	180-185	40-45	1.61	0.200	205	210	6.8
powdered orange do group (ALBEDO)									
WF + 5% Albedo	6	2-3	180-185	40-45	2.10	0.190	188	196	7.00
WF + 10% Albedo	7	2-3	180-185	40-45	2.14	0.196	193	202	7.3
WF + 15% Albedo	8	2-3	180-185	40-45	2.22	0.199	208	212	7.5
n flour group (CF)									
WF + 10% CF	9	2-3	180-185	40-45	1.70	0.186	193	198	7.5
WF + 20% CF	10	2-3	180-185	40-45	1.76	0.190	196	200	7.9
WF + 30% CF	11	2-3	180-185	40-45	1.84	0.194	210	220	8.4
powdered beet roots up									
WF + 4% BR	12	2-3	170	30-35	1.20	0.232	187	192	6.8
WF + 6 % BR	13	2-3	170	30-35	1.13	0.260	190	194	6.82
WF + 8 % BR	14	2-3	170	30-35	1.01	0.300	194	198	6.9

As is basis.
Average of duplicate determination.

Table (20): Effect of frying process on the firmness, color, moisture and lipi content of instant noodles prepared from 65% extraction whe flour substituted by different levels of various additives.

Experimental blends used to prepare noodles (%)	Sample No.	Steaming time (min	Experimental fried noodles samples*						
			Temp. frying (c)°	Time (sec)	Firmness (kg/cm²)**	Color	Cooking quality properties		
							Weight gain (%)	Volume gain (%)	Cookin loss (%)
Control group (WF)									
Wheat flour 65% ext.	1	2-3	180-185	40-45	1.33	0.132	183	193	5.33
Okara flour group (OF)									
95% WF + 5% OF	2	2-3	180-185	40-45	1.35	0.140	190	198	5.5
90% WF + 10% OF	3	2-3	180-185	40-45	1.41	0.166	195	205	5.7
85% WF + 15% OF	4	2-3	180-185	40-45	1.46	0.172	200	210	5.9
80% WF + 20% OF	5	2-3	180-185	40-45	1.51	0.179	210	215	6.01
Dry orange albedo group (ALBEDO)									
95% WF + 5% Albedo	6	2-3	180-185	40-45	1.82	0.157	192	199	5.4
90% WF + 10% Albedo	7	2-3	180-185	40-45	1.86	0.171	197	207	5.6
85% WF + 15% Albedo	8	2-3	180-185	40-45	1.90	0.179	210	215	5.9
Corn flour group (CF)									
90% WF + 10% CF	9	2-3	180-185	40-45	1.51	0.156	194	208	5.7
80% WF + 20% CF	10	2-3	180-185	40-45	1.56	0.166	199	212	5.9
70% WF + 30% CF	11	2-3	180-185	40-45	1.61	0.171	215	225	6.00
Dry powdered beet roots group (BR)									
96% WF + 4 % BR	12	2-3	170	30-35	1.21	0.233	187	196	5.7
94% WF + 6 % BR	13	2-3	170	30-35	1.18	0.245	190	199	5.8
92% WF + 8 % BR	14	2-3	170	30-35	1.14	0.249	195	200	5.9

* As is basis

** Average of duplicate determination

A. Okara flour:

The substitution of wheat flours by okara flour at levels of 5,10, 15 and 20% resulted in increasing firmness values with the inclusion of OF and also increasing the level of substitution to1.56, 1.60, 1.67 and 1.84 kg / cm2 , respectively , in the 82% ext. group; 1.50, 1.54, 1.59 and1.61 kg / cm2 , respectively, in the 72% ext. group; and 1.35, 1.41, 1.64 and 1.51 kg / cm2 , respectively, in the 65% ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (1.53, 1.44 and 1.33 kg / cm^2 ,respectively).

In a similar pattern, color values showed gradual increase with the inclusion of and also increasing the level of substitution which reached 0.205, 0.225, 0.239 and 0.267, respectively, in the 82% ext. group, 0.160, 0.180, 0.193 and 0.200 , respectively, in the 72% ext. group, and 0.140, 0.166, 0.172 and 0.179, respectively, in the 65% ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (0185, 0.155 and 0.132, respectively).

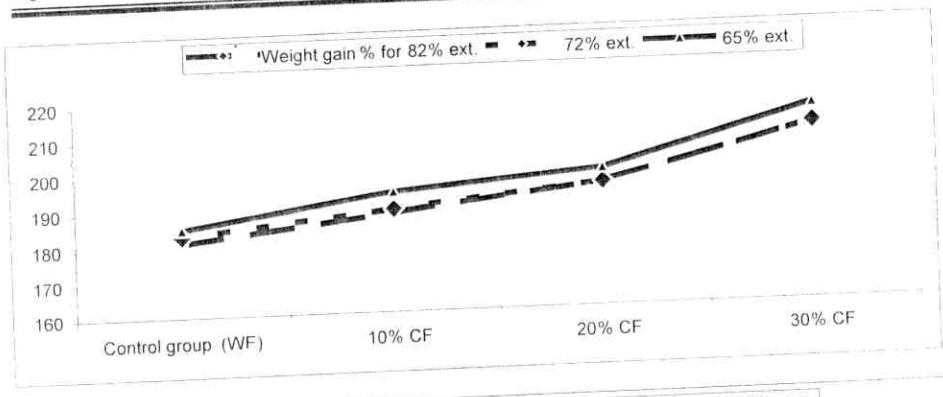
In addition, values for the cooking quality properties were increased by increasing the level of substitution, where weight gain values increased to 185, 188, 193 and 197 % ,respectively, in the 82% ext. group, respectively ; 186, 190, 196 and 205 % in the 72% ext. group, 190, 195, 200 and 210 %,respectively, in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (180, 181 and 183 % , respectively).

Similarly, volume gain were increased to 188, 192, 195 and 200 %,respectively, in the 82% ext. group, 194, 199,200 and 210 % in the 72% ext. group, respectively ; and 198, 205, 210 and 215 %

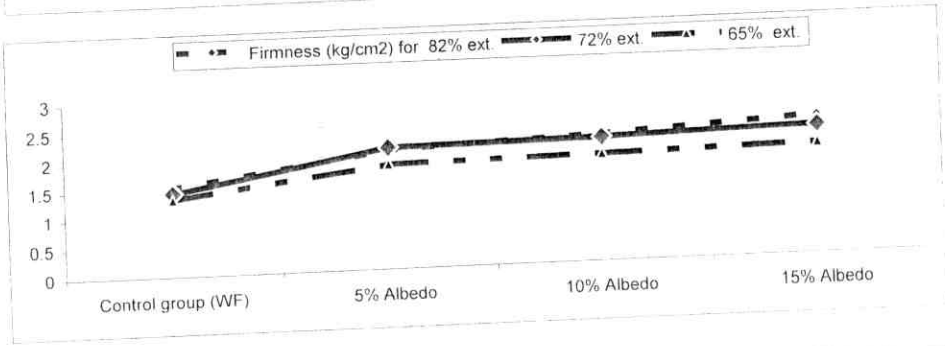
,respectively, in the 65% ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (185, 188 and 193% , respectively).

Subsequently, cooking loss values were increased by increasing the OF level of substitution (7.9, 8.1, 8.3 and 8.6 %,respectively, in the 82% ext. group, 7, 7.2, 7.5 and 7.8 %, respectively, in the 72% ext. group, and 5.5, 5.7, 5.9 and 6.00 % ,respectively, in the 65% ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (7.8, 6.72 and 5.33 % , respectively,).

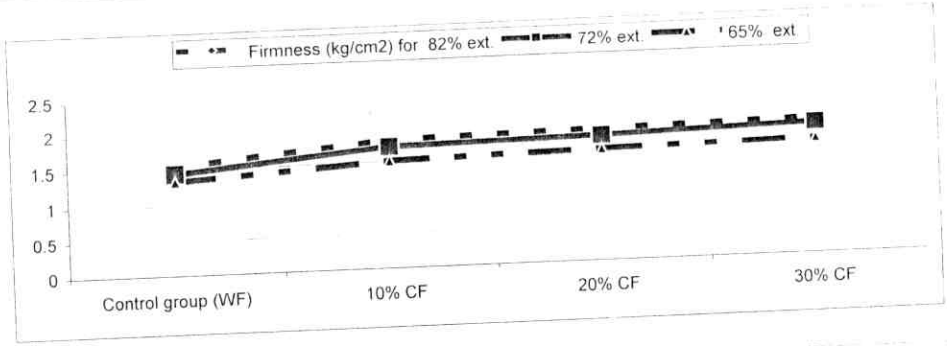
The observed higher cooking quality for OF group noodles, which is proportional to increase in substitution level of OF, could be related to the previously observation of high protein content found in Okara starting flour (Table 6). Many researchers agree that protein content , in particular, such as in the original wheat flour , influence greatly the noodles eating quality **(Miskelly ,1984 ; Oh *et al.*, 1985a Baik *et al.*,1994).**



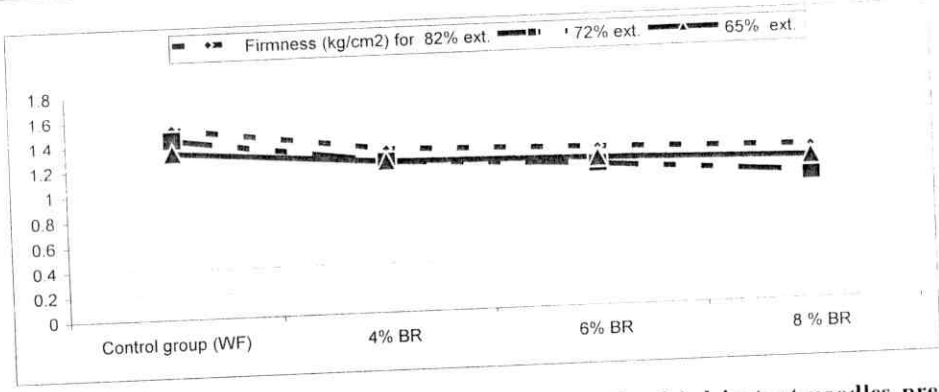
A



B

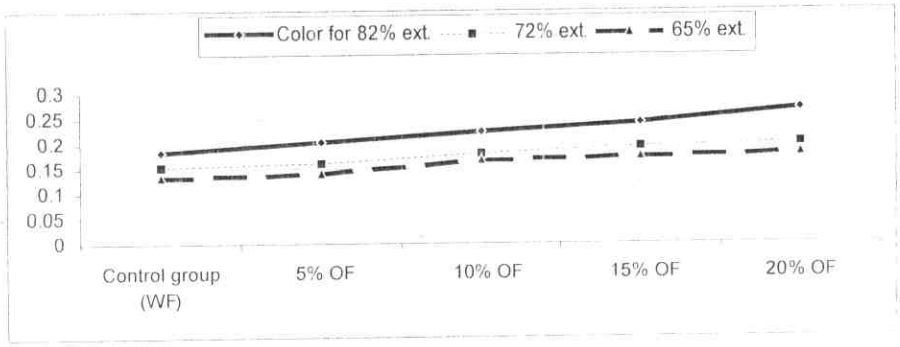


C

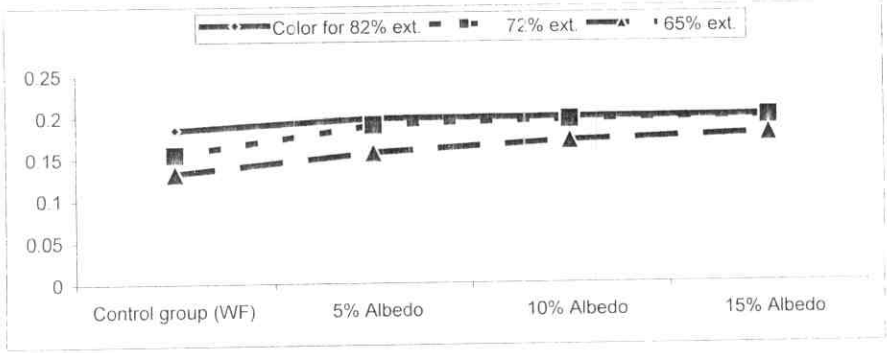


D

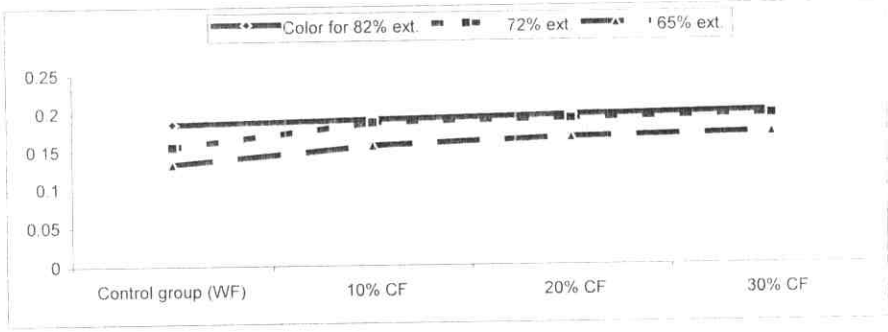
Fig (5): Effect of frying process on the firmness values for fried instant noodles prepared from 82%, 72%, 65%, extraction wheat flours (WF) substituted by different levels of various substitutes. [**A:** Okara flour (OF); **B:** Dry orange albedo (ALBEDO) : **C:** Corn flour (CF) and **D:** Beet roots (BR)]



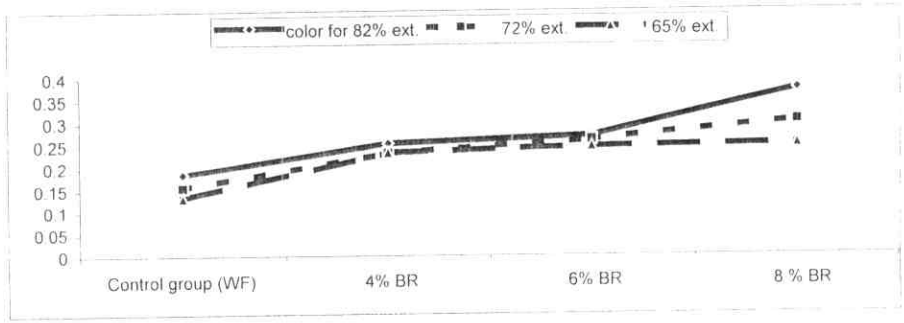
A



B

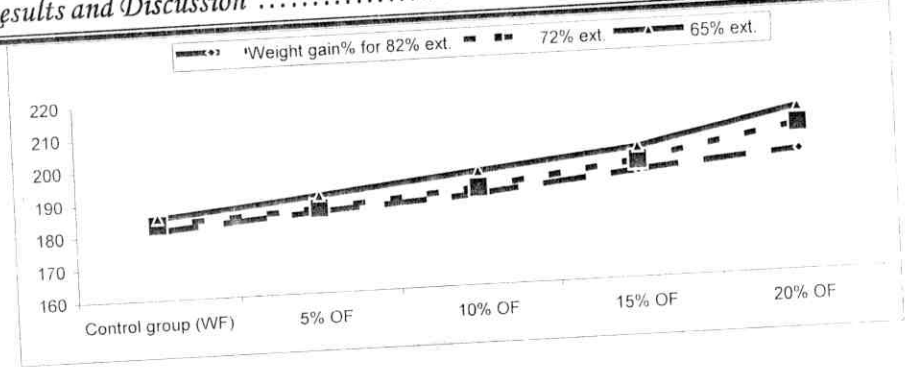


C

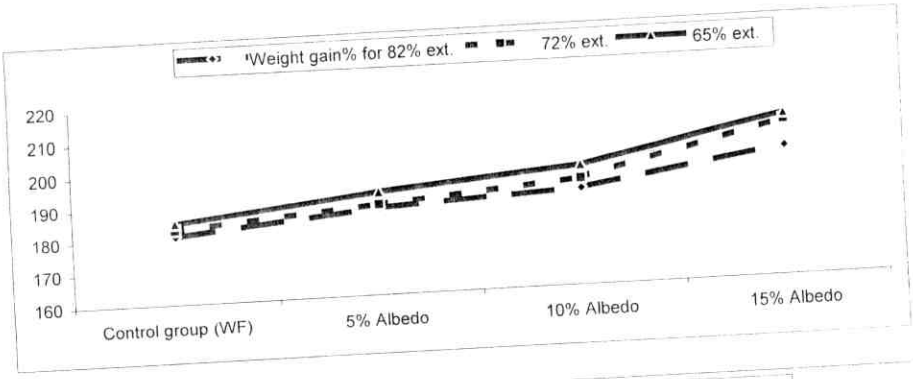


D

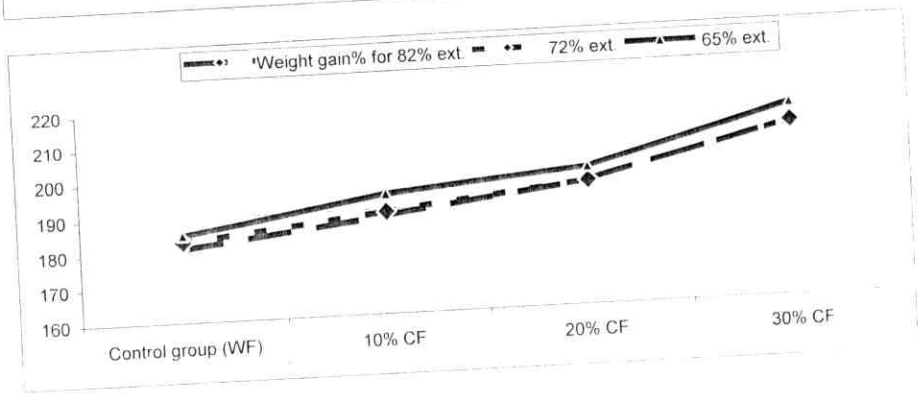
Fig (6): Effect of frying process on the color content of instant noodles prepared from 82%, 72%, 65%, extraction wheat flour substituted by different levels of various additives [A.: Okara flour (OF); **B:** Dry orange albedo (ALBEDO) ; **C:** Corn flour (CF) ; **D:** Beet roots (BR)]



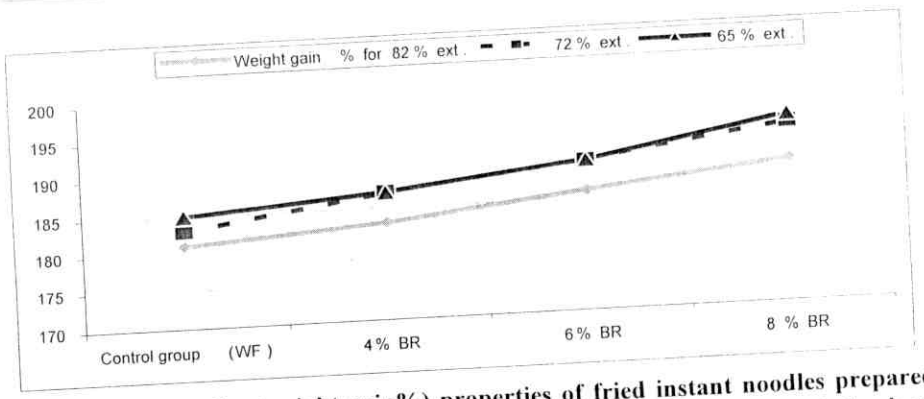
A



B

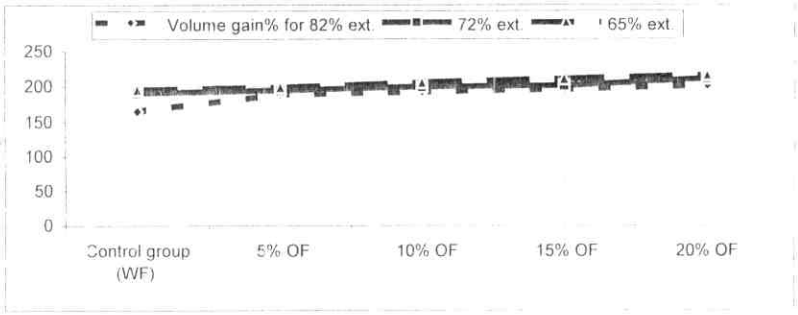


C

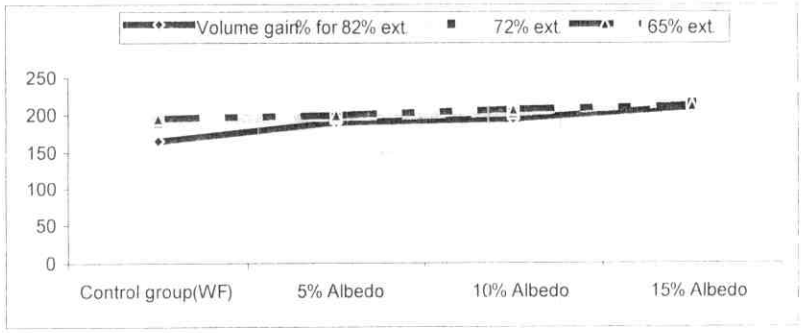


D

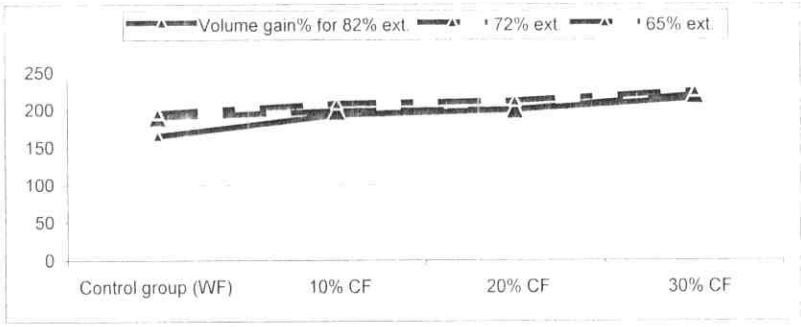
Fig (7): Cooking quality (weight gain%) properties of fried instant noodles prepared from wheat flours (82%, 72%, 65% extractions) substituted by different levels of some natural products. [A: Okara flour (OF) ; **B**: Dry orange albedo (ALBEDO) ; **C**: Corn flour (CF) and **D**: Beet roots (BR)]



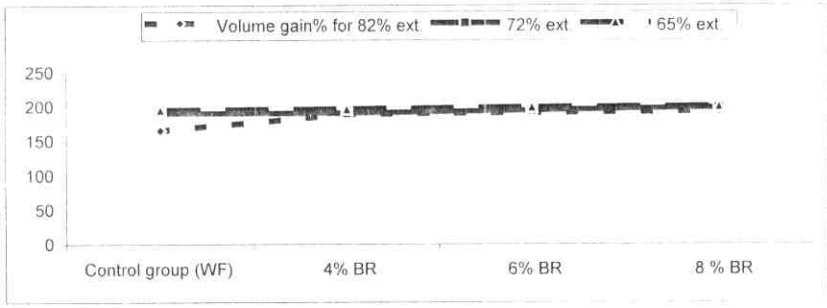
A



B

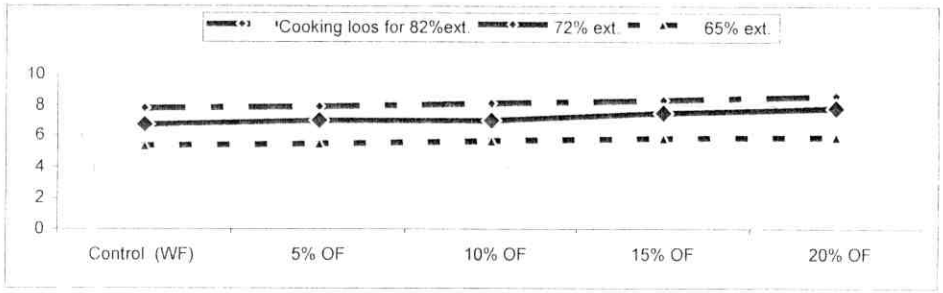


C

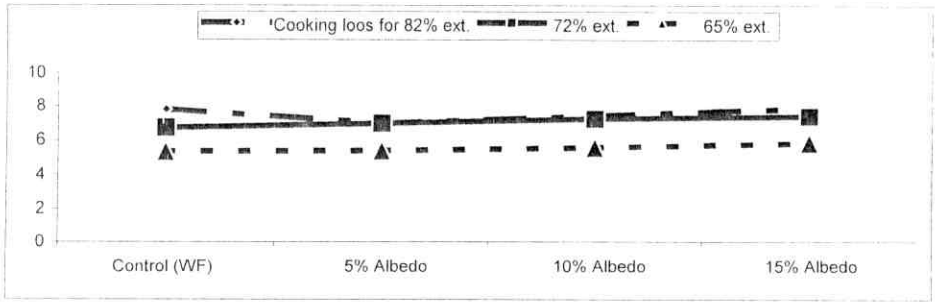


D

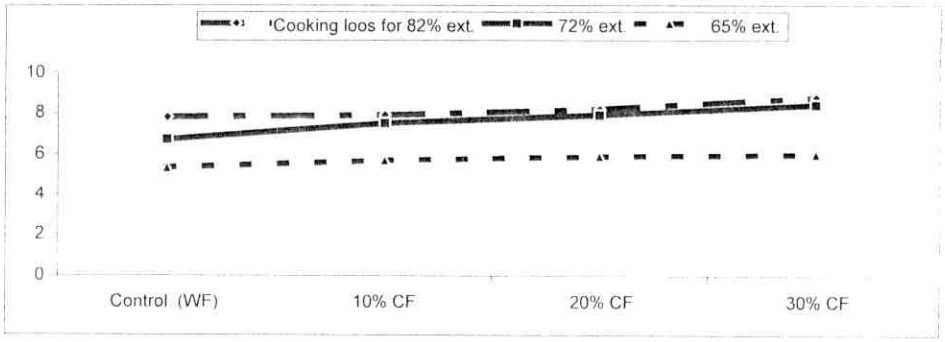
Fig (8): Cooking quality (volume gain%) properties of fried instant noodles prepared from wheat flours 82%, 72%, 65% extractions substituted by different levels of some natural products [**A:** Okara flour (OF); **B:** Dry orange albedo (ALBEDO) ; **C:** Corn flour (CF) ; **D:** Beet roots (BR)].



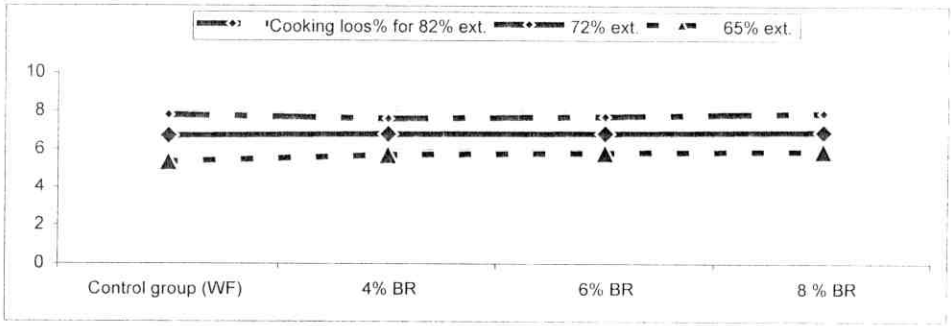
A



B



C



D

Fig (8): Cooking quality (Cooking loos%) properties of fried instant noodles prepared from wheat flours 82%, 72%, 65% extractions substituted by different levels of some natural products [**A:** Okara flour (OF); **B:** Dry orange albedo (ALBEDO) : **C:** Corn flour (CF) : **D:** Beet roots (BR)].

B. Dry powdered orange albedo (ALBEDO):

The inclusion and substitution of wheat flours by orange albedo flour increased firmness values by increasing level of substitution to 5,10 and 15 % where it reached 2.06, 2.19 and 2.39 kg / cm^2,respectively, in the 82% ext. group, 2.10, 2.14 and 2.22 kg / cm^2,respectively, in the 72% ext. group, and 1.82 , 1.86 and 1.90 kg / cm^2 ,respectively, in the 65% ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (1.53, 1.44 and 1.33 kg / cm^2 ,respectively).

Similarly, color values were increased 0.198, 0.199, and 0.200, respectively, in the 82% ext. group, respectively ; 0.190, 0.196, and 0.199, respectively, in the 72% ext. group; and 0.157, 0.171, and 0.179 in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (0.185, 0.155 and 0.132, respectively).

In addition , values for the cooking quality properties were increased by the inclusion and increasing level of substitution where weight gain reached 187, 190, and 200 %, respectively, in the 82% ext. group ; 188, 193 and 208 % , respectively, in the 72% ext. group ; and 192, 197 and 210 % , respectively , in the 65% ext. group, compared with the corresponding 82, 72 and 65% ext. WF control fried noodles (180, 181 and 183 % , respectively).

Volume gain were also increased to 190, 194 and 210 % in the 82% ext. group, respectively ; 196, 202 and 212 % i in the 72% ext. group, respectively ; and 199, 207 and 215 % in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control steamed noodles (185, 188 and 193 % ,respectively,).

respectively ; in the 65% ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (0.185, 0.155 and 0.132 , respectively).

Values for the cooking quality properties were increased by inclusion and increasing substitution level of BR where weight gain increased to 183, 186, and 189 %, respectively ; in the 82% ext. group,; 187, 190 and 194%, respectively ; in the 72% ext. group; and 187, 190 and195% , respectively ; in the 65% ext. group, respectively, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (180, 181and 183 % ,respectively).

Volume gain were also increased (188, 190 and 192 % , respectively ; in the 82% ext. group, 192, 194 and 198 % , respectively ; in the 72% ext. group, and 187, 190 and 200 %, respectively ; in the 65% ext. group, respectively), compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (185, 188 and 193 %, respectively,)

Cooking loss values showed similar pattern of increase (7.9, 8.00 and 8.2 % , respectively ; in the 82% ext. group; 6.80, 6.82 and 6.90 % , respectively ; in the 72% ext. group, and 5.7, 5.8 and 5.9 %, respectively ; in the 65%ext. group, compared with the corresponding 82 , 72 and 65% ext. WF control fried noodles (7.8, 6.72 and 5.33 % , respectively).

From tables 20,21 and 22 as well as figures 5 ,6, 7, 8.and 9 , it could be noticed that , regardless of the kind of substitute, firmness values for all cooked fried noodles incresed with increasing level of substitution. This is mainly due to that noodles fried contained high amounts of coloring pigments specially those substituted by okora flour, dry powdered orange albedo and dry powdered beet roots. Furthermore, the long time elapsed in frying noodles in high

amount of lipid and ,also , the low content of moisture upon frying caused a compact noodles structure.

In addition, it could be observed that color values of noodles increased with increasing frying process and increasing substitution level, regardless of the kind of substitute. This could be attributed partly to the fact that fried noodles contained originally high amounts of coloring pigments, especially those substituted by okara flour, dry powdered orange albedo and dry powdered beet roots. On the other hand, , this could be due to the browning reactions which occurred at high the temperature for a long time used during frying of noodles . These results are in close agreement with those obtained by **Mazza (1986)** who stated that browning reactions in cereal products increased with increasing heating temperature of their preparation.

In addition, the obtained results revealed that values for weight gain, volume gain and cooking loss were found to be increase in proportion to the increase in substitution level , regardless of the kind of substitute used in making noodles . Similar results were reported by **Lorenz and lough. (1992)** and **Gu-Sik and Sung- Kon (1991**who found that values for cooking loss of noodles were increased as the substitution of the corn flour percentage reached 15%, they also reported that cooking loss increased from 4.95% to 7.8% for fried noodles cooked for 1 min. and 4 min., respectively. Furthermore, **Grant *et al.* (1993)** reported that cooking weight and cooking loss for spaghetti were increased as length of cooking time increased.

Generally speaking, from the obtained data , however ,it could be noticed that all cooking quality parameters tested of instant fried noodles made from wheat flour 82 ,72 and 65% extractions where

they showed an marked increase over their corresponding WF noodles by increasing the substitution of levels of WF by OF, ALBEDO, CF, BR. On the other hand, , those made from wheat flour 65% extraction showed a higher rate of increase in weight and volume gain ,but much lower rate of increase in cooking loss compared to 82 and 72% ext. noodles, regardless of kind of substitutes and substitution levels utilized

This observation could be attributed to the difference in chemical composition between the 82 ,72 and 65% extractions WF. Furthermore, this observation demonstrate that WF of 65% ext. was found superior to the 82 and 72% ext WF in making noodles, regardless of kind of substitutes and substitution level utilized. In addition the same observation was also noted during investigating the cooking quality parameters of steamed noodles with or without substitution.

4.6. Study of the effect of wheat flour extraction rate , kind and substitution level of some natural products on proximate chemical composition of the experimental fried instant noodles:

The proximate chemical composition of instant noodles prepared from wheat flours of 82, 72, and 65% ext. and their corresponding noodles substituted by different levels of natural substitutes were fully investigated. These substitutes were found previously, from the chemical composition standpoint, to be rich in proteins, fibers, and minerals and therefore were considered of great potential to substitute, separately, wheat flours of different extraction rates in making noodles . Noodles prepared using okara, dry powdered orange albedo and corn flour were fried at 180 to

185C^0 for 40 to 45 sec., while those prepared from dry powdered beet roots were fried at 170C^0 for 30-35 sec.

4.6.1. Effect of variation in extraction rate of wheat flours on proximate chemical composition of prepared experimental fried instant noodles:

The effect of using different wheat flours of various extraction rates (82, 72, and 65% ext.)on the proximate chemical composition of their experimental instant noodles fried at 180-185^{0}C for 40-45 sec. are demonstrated in tables 21, 22 and 23 as well as figures 10, 11 and 12 .

The experimental fried instant noodles prepared from 82 % extraction WF exhibited the highest content in crude proteins (14.21 %).crude fat (19.5%) and crude fibers (1.6%) , but the lowest content in total carbohydrates (57.2%).

The experimental fried instant noodles prepared from 65 % extraction WF exhibited the lowest content in crude proteins (11.51 %).crude fat (19.00%) and crude fibers (0.29%) ,but the highest content in total carbohydrates (63.36 %).

The differences previously observed in the proximate chemical composition of starting WF (of three ext. rates) used in making the examined noodles (table4) could explain the obtained data for proximate chemical composition of their fried noodles. Wheat flour 82% ext. was found the highest in contents in crude proteins , ash and crude fibers, but the lowest in total carbohydrates compared to those flours of 72% and 82% extraction. Alternatively, the 65% extraction flour contained the lowest proteins, ash, fibers and lipids contents, but the highest total carbohydrates compared to those flours of 72% and 82% extraction.

4.6.2. Effect of kind of natural substitutes on proximate chemical composition of prepared fried experimental instant noodles:

The chemical composition of fried instant noodles produced from wheat flours (82, 72, and 65% ext.)and their corresponding noodles groups substituted by different levels of okara (OF), dry powdered orange albedo (ALBEDO), corn flour (CF) and dry powdered beet roots (BR) are tabulated in table 21, 22 and 23 and illustrated in figures 10,11, and12.

Regardless of level of substitution, substituting of WF of 82, 72, and 65% ext. rate , respectively, by okara flour resulted in increasing contents of resultant instant noodles in crude proteins (15.28 to 18.47 % ;13.18 to 16.7 % and 12.73 to 16.4 %,respectively), crude fats (20.3 to20.2%) ash (ranged from 1.63 to 1.94%), and crude fibers (ranged from 1.9 to 2.67%), but total carbohydrates decreased .

Substituting of WF of 82, 72, and 65% ext. rate , respectively, by dry powdered orange albedo resulted in increasing content of the resultant instant noodles in crude fibers (ranged from 2.35 to 3.9) and ash (ranged from 0.18 to 1.78 %) ,but crude proteins and total carbohydrates decreased compared to values found in WF noodles controls.

Regardless of level of substitution, substituting of WF of 82, 72, and 65% ext. rate, respectively, by corn flour caused content of the resultant instant noodles to increase in total carbohydrates (ranged from 60.92 to 61.77 %) and crude fibers (ranged from 1.70 to 2.0 %), but a decrease in their content of crude proteins (13.64 to 12.5 %), followed by crude fats (ranged

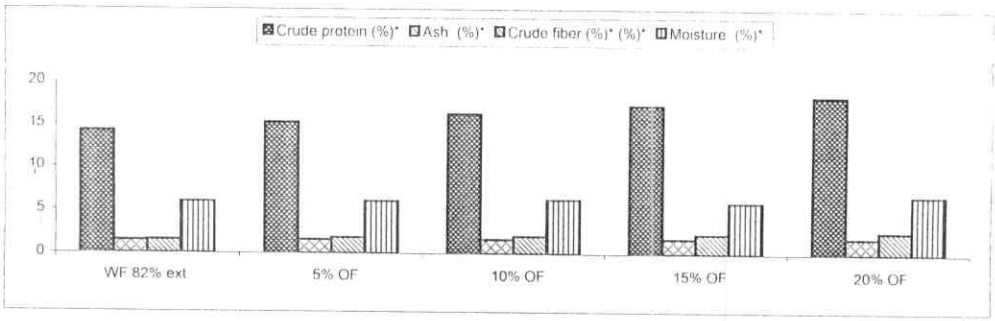
from 17.96 to 16.6 %)and ash (ranged from 1.48 to 1.44 %) compared to values found in WF noodles controls.

Table (21): Chemical composition of fried instant noodles produced from wheat flour 82% ext. (WF) substituted by different levels of okara dry flour (OF), Dry orange albedo (ALBEDO), corn flour and Dry powdered beet roots (BR), (% on dry weight basis).

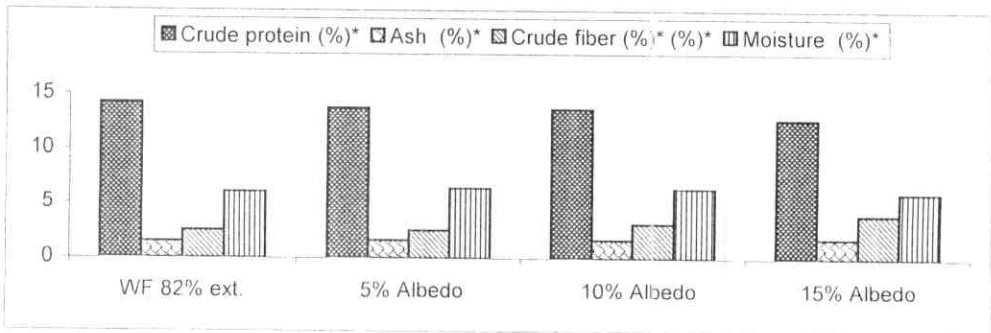
Raw materials	Analyses							
	Sample No.	Substitution level (%)	Crude protein (%)*	Fat (%)*	Ash (%)*	Crude fiber (%)*	Moisture (%)*	Total carbo-hydrates**
Control group (WF)								
Wheat flour 82% ext.	1	0	14.21	19.00	1.50	1.6	6.00	57.2
Okara flour group (OF)								
95% WF + 5% OF	2	5	15.28	21.13	1.63	1.9	6.1	54.06
90% WF + 10% OF	3	10	16.34	21.00	1.71	2.1	6.3	53.3
85% WF + 15% OF	4	15	17.41	20.58	1.83	2.36	6.00	52.4
80% WF + 20% OF	5	20	18.47	20.06	1.94	2.67	6.84	52.00
Dry orange albedo group (ALBEDO)								
95% WF + 5% Albedo	6	5	13.72	20.96	1.61	2.35	6.33	54.9
90% WF + 10% Albedo	7	10	13.64	19.67	1.68	3.1	6.30	56.1
85% WF + 15% Albedo	8	15	12.73	19.67	1.78	3.9	5.91	50.35
Corn flour group (CF)								
90% WF + 10% CF	9	10	13.64	17.96	1.48	1.7	6.00	60.92
80% WF + 20% CF	10	20	13.04	16.95	1.48	1.87	5.66	63.96
70% WF + 30% CF	11	30	12.5	16.63	1.44	2.00	5.66	61.77
Dry powdered beet roots group (BR)								
96% WF + 4 % BR	12	4	13.7	18.87	1.7	1.57	6.01	59.7
94% WF + 6 % BR	13	6	13.4	19.00	1.76	1.56	600	58.7
92% WF + 8 % BR	14	8	13.2	20.16	1.80	1.48	600	58.00

* Average of duplicate determination.

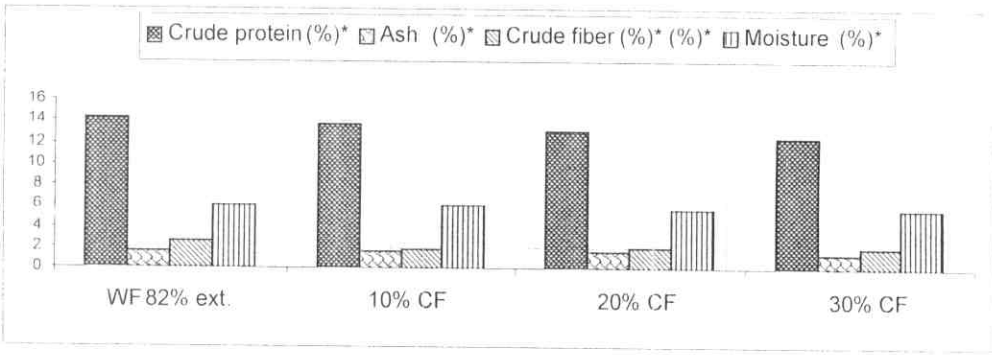
** Calculated by difference.



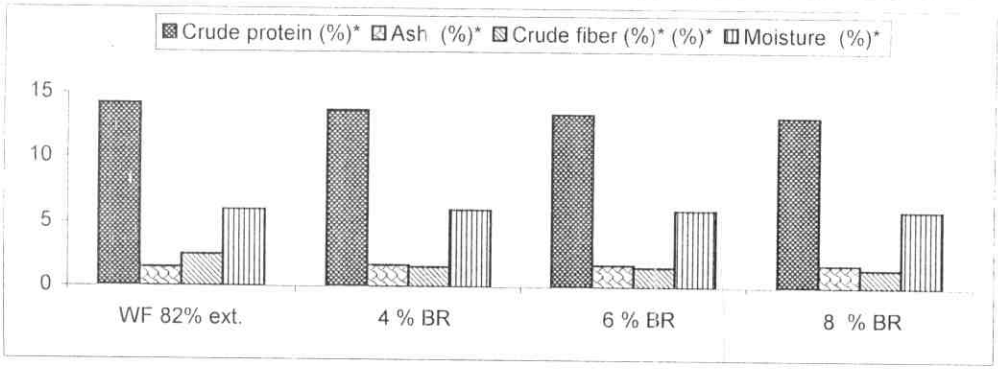
A



B



C



D

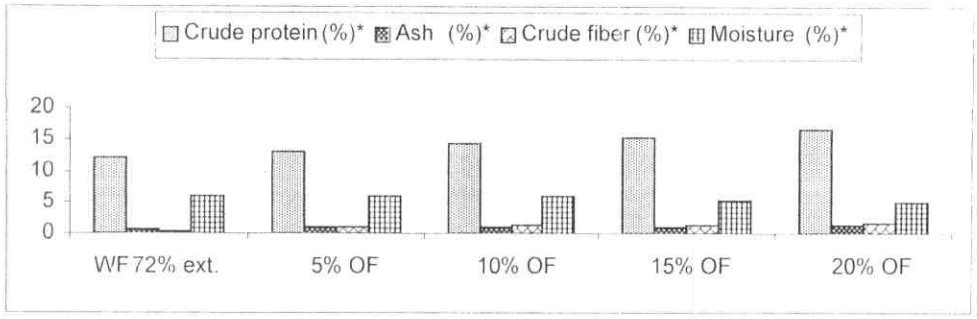
ig (10) : Chemical composition of fried instant noodles produced from wheat flour 82% ext. (WF) substituted by different levels of : A: Okara dry flour (OF) ; **B:** Dry orange albedo (ALBEDO) ; **C:** Corn flour(CF) and **D:** Dry powdered beet roots (BR)] (Crude fat and total carbohydrates are excluded).

Table (22): Chemical composition of fried instant noodles produced from wheat flour 72% extraction (WF) substituted by different levels of okara flour (OF), dry powdered orange albedo (ALBEDO) , corn flour (CF) and dry powdered beet roots (BR), (% on dry weight basis).

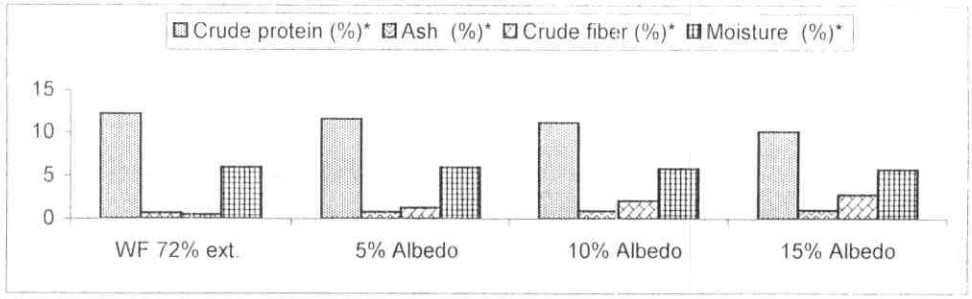
Raw Materials	Analyses							
	Sample No.	Substitution level (%)	Crude protein (%)*	Fat (%)*	Ash (%)*	Crude fiber (%)*	Moisture (%)*	Total carbo - hydrates**
Control group (WF)								
Wheat flour 72% ext.	1	0	12.21	19.00	0.71	0.49	6.00	61.09
Okara flour group (OF)								
95% WF + 5% OF	2	5	13.18	20.00	0.83	0.87	6.00	59.39
90% WF + 10% OF	3	10	14.35	20.10	0.97	1.15	6.00	56.26
85% WF + 15% OF	4	15	15.53	20.90	1.11	1.47	5.32	56.00
80% WF + 20% OF	5	20	16.7	21.00	1.25	1.79	5.00	54.7
Dry orange albedo group (ALBEDO)								
95% WF + 5% Albedo	6	5	11.6	20.11	0.81	1.32	600	54.5
90% WF + 10% Albedo	7	10	11.2	19.32	0.94	2.15	5.85	60.3
85% WF + 15% Albedo	8	15	10.2	19.00	1.03	2.89	5.80	60.5
Corn flour group (CF)								
90% WF + 10% CF	9	10	11.65	17.20	0.74	0.75	5.30	61.00
80% WF + 20% CF	10	20	11.3	17.10	0.79	0.99	4.5	65.00
70% WF + 30% CF	11	30	10.95	16.20	0.84	1.33	4.5	65.31
Dry powdered beet roots group (BR)								
96% WF + 4 % BR	12	4	11.5	17.88	0.87	0.51	5.99	65.5
94% WF + 6 % BR	13	6	11.3	18.11	0.96	0.52	5.90	63.00
92% WF + 8 % BR	14	8	11.00	18.91	1.2	0.55	5.32	63.12

* Average of duplicate determination

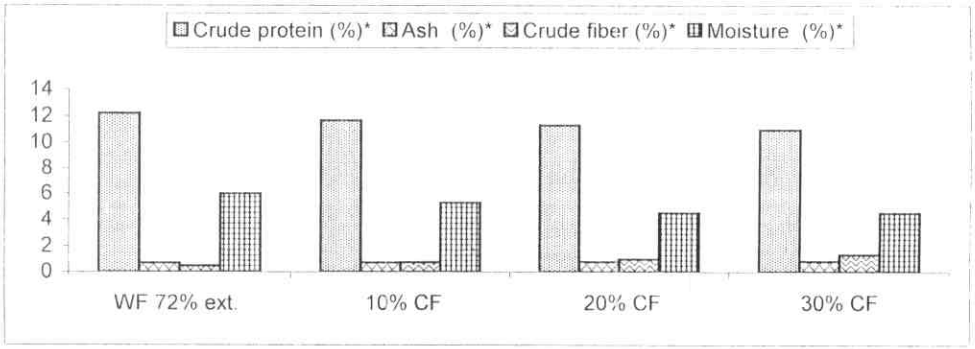
* Calculated by difference.



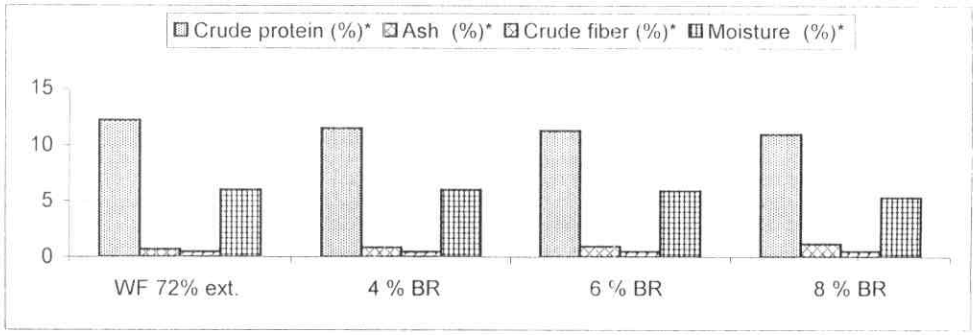
A



B



C



D

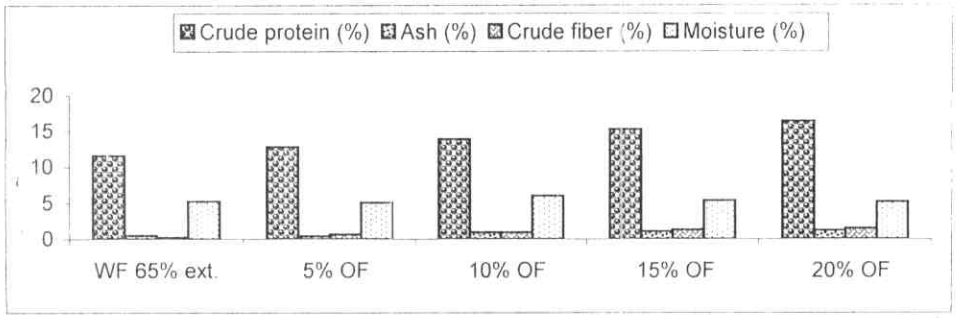
Fig (11) : Chemical composition of fried instant noodles produced from wheat flour 72% extraction (WF) substituted by different levels of A: Okara flour (OF), **B:** Dry powdered orange albedo(ALBEDO) ; **C:** Corn flour (CF) and **D:** Dry powdered beet roots (BR) , (Crude fat and total carbohydrates are excluded).

le (23): Chemical composition of fried instant noodles produced from 65% extraction wheat flour (WF) substituted by different levels of okara flour (OF), dry powdered orange albedo (ALBEDO) , corn flour (CF) and dry powdered beet roots (BR), (% on dry weight basis).

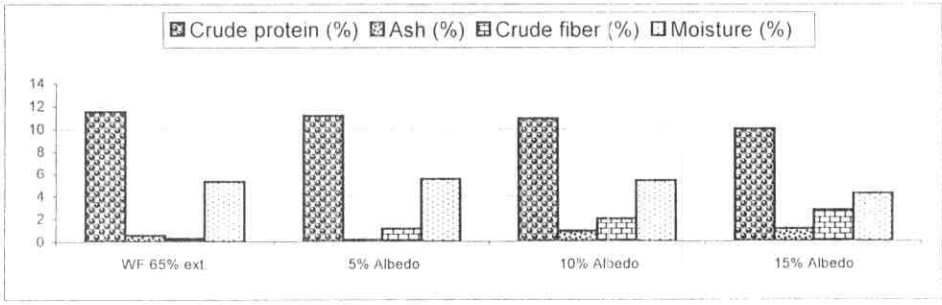
Raw materials	Analyses							
	Sample No.	Substitution level (%)	Crude protein (%)*	Fat (%)*	Ash (%)*	Crude fiber (%)*	Moisture (%)*	Total carbohy-drates**
ntrol group (WF)								
ıeat flour 65% ext.	1	0	11.51	18.99	0.55	0.29	5.3	63.36
ara flour group (OF)								
:% WF + 5% OF	2	5	12.73	19.00	0.44	0.67	5.1	62.06
)% WF + 10% OF	3	10	13.85	19.52	0.94	0.97	6.01	58.6
;% WF + 15% OF	4	15	15.2	19.99	1.1	1.3	5.36	57.00
)% WF + 20% OF	5	20	16.4	20.11	1.22	1.5	5.20	54.97
y powdered orange)edo group (Albedo)								
;% WF + 5% Albedo	6	5	11.15	20.00	0.18	1.13	5.50	62.04
)% WF + 10% Albedo	7	10	10.93	19.01	0.91	1.97	5.37	61.5
5% WF + 15% Albedo	8	15	10.00	18.80	1.1	2.73	4.21	64.55
)rn flour group (CF)								
0% WF + 10% CF	9	10	11.15	17.00	0.71	0.57	5.22	63.34
0% WF + 20% CF	10	20	10.9	16.77	0.76	0.84	4.98	65.15
0% WF + 30% CF	11	30	10.7	16.00	0.82	1.1	4.21	65.5
ry powdered beet roots roup (BR)								
)6% WF + 4 % BR	12	4	11.13	17.00	0.83	0.33	5.11	65.5
)4% WF + 6 % BR	13	6	10.87	17.90	0.94	0.35	5.00	63.63
)2% WF +% BR	14	8	10.66	18.60	1.03	0.40	4.23	63.83

* Average of duplicate determination.

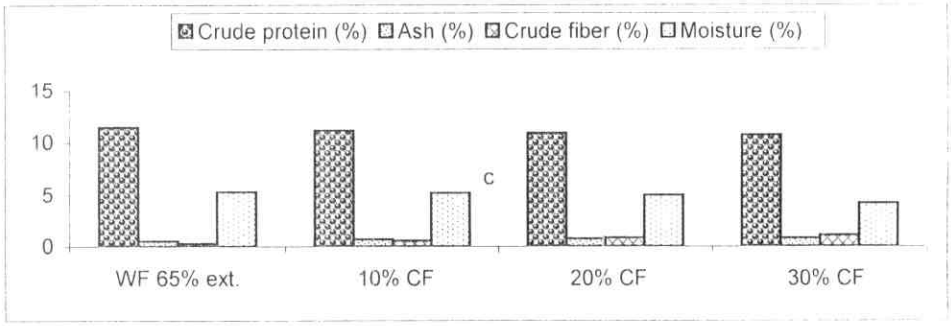
* Calculated by difference.



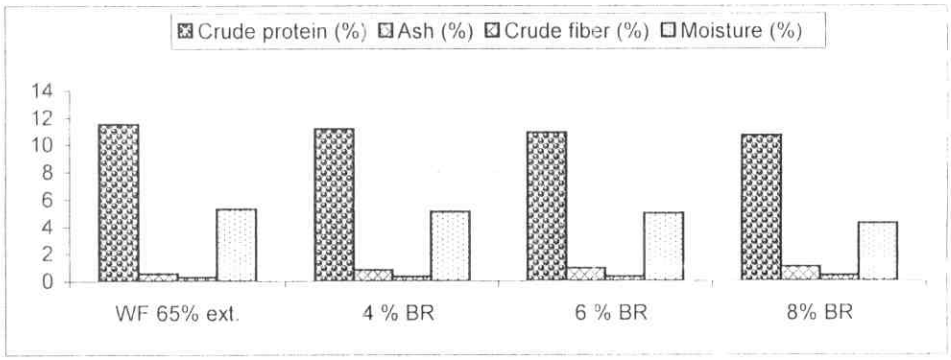
A



B



C



D

Fig (12): Chemical composition of fried instant noodles produced from wheat flour 65% extractio (WF) substituted by different levels of A: Okara flour (OF), **B:** Dry powdered orang albedo(ALBEDO) ; **C:** Corn flour (CF) and **D:** Dry powdered beet roots (BR)] (Crude fat ar total carbohydrates are excluded).

Regardless of level of substitution, substituting of wheat flours of 82, 72, and 65% extraction rate, respectively, by dry powdered beet roots increased the content of the resultant instant noodles in ash (ranged from 1.7 to 1.8 %) but decreases crude proteins and crude fibers compared to values found in WF noodles controls.

Crude fats and moisture content of fried noodles decreased with the inclusion regardless of the kind of substitutes. However, it is not practical to rely on the obtained values for crude fats and moisture content of all experimental fried noodles analyzed, due to the fact that frying process removed the water content of noodles doughs and also incorporated the oil of frying into the noodle **(Kim, 1996).**

Moreover, it was not possible, practically, to standardize exactly the frying process conditions such as time and temperature as well as the amount of oil absorption by paper tissues after the completion of frying.

In general ,substituting of wheat flours by the four natural substitutes produced different pattern of increment in chemical constituents of experimental noodles prepared from each kind of substitutes tested. The substitution of WF by okara flour resulted in increasing crude proteins content , while orange albedo increased crude fibers content , corn flour increased total carbohydrates, and beet roots increased ash content.

4.6.3. Effect of level of natural substitutes on proximate chemical composition of prepared fried experimental instant noodles

The chemical composition of fried instant noodles produced from wheat flours (82, 72, and 65% ext.).and their corresponding noodles groups substituted by different levels of okara (5,10 15 and 20 % OF), dry powdered orange albedo (5,10 and 15 % ALBEDO), corn flour (10, 20 and 30 % CF) and dry powdered beet roots (BR) are tabulated in table 23.24 and 25 and illustrated in figures .

A. Okara flour(OF):

Results in tables indicate that substituting wheat flours by okara flour at levels of 5,10, 15, and 20 % ,respectively, increased the crude protein content of fried noodles with the increase in substitution level , whereas they reached 15.28, 16.34, 17.41and 18.47, respectively, in the OF group made from 82 % ext. WF ; 13.18, 14.35, 15.53, 16.7 respectively, in the OF group made from 72 % ext. WF ; 12.73, 13.85, 15.2, and 16.4, respectively, in the the OF group made from 65 % ext. WF compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (14.21, 12.21, and 11.51%, respectively).

Ash content of instant fried noodles of the four okara flour group, respectively, were increased, with the increase in substitution level ,to values of 1.63, 1.71, 1.83 and 1.94% , respectively, in the OF group made from 82 % ext. WF ; 0.83, 0.97, 1.11 and 1.25% , respectively, in the OF group made from 72 % ext. WF ; 0.44, 0.94, 1.1 and 1.22 %, respectively, in the OF group made from 65 % ext. WF compared to their corresponding WF controls(1.50, 0.71 and 0.55 % , respectively).

Crude fibers content of instant fried noodles of okara flour noodles substituted at levels of 5,10, 15, and 20 % ,respectively were also increased, with the increase in substitution level, to values of 1.9,2.1 2.36 and 2.67% , respectively, in the OF group made from 82 % ext. WF ; 0.87,1.15, 1.47 and 1.79% , respectively, in the OF group made from 72 % ext. WF ; and 0.67,0.97, 1.3, and1.5 %, respectively, in the OF group made from 65 % ext. WF compared to their corresponding WF controls

(1.6, 0.49 and 0.29 % , respectively).

On opposite direction, the substitution of wheat flours by okara flour decreased the total carbohydrates content of the produced noodles, regardless of the level of substitution, (which ranged from 52.0 to 54.06 % in the OF group made from 82 % ext. WF ; from 54.7 to 59.39 % in the OF group made from 72 % ext. WF: and from 54.97 to 62.06 in the OF group made from 65 % ext. WF) compared to 82 ,72 and 65 %ext. WF noodle controls (57.2, 61.09 and 63.36%, respectively).

Moisture content of fried noodles ranged between 5.0 to 6.3 % which was within the range of their corresponding 82, 72 and 65 %WF controls (6.0 , 6.0 and 5 3. % , respectively). In the same trend ,crude fats content of fried noodles which ranged between 19 to21 % was within the range of their corresponding 82, 72 and 65 %WF controls (19.5,19.0 and 18.99 % , respectively).

Generally speaking, regardless of level of substitution and ext. rate of starting WF, substituting of WF by okara flour resulted in increasing contents of crude proteins (between 12.70 to 18.5 %) , ash (between 0.44 to 1.9%) and crude fibers (between o.67 to 2. 6%) of the resultant instant noodles

These results were in agreement with those reported by **Abdala (1988)** he found that substitution of WF by okara flour increased protein content of the final product. Furthermore , these findings of high protein content in okara noodle group at all levels of substitution are in agreement with the data found by **Fahmey *et al.* (1981)** who reported that legume seeds, such as soy bean , contain large amount of proteins and ,thus, contribute in increasing proteins content of their products.

Furthermore, these results of the chemical composition of okara noodles are in general agreement with the data found by **Bahnassey and Khan (1996)** who reported that all legume flours contain significantly higher proteins, ash and crude fibers contents which results in increasing proteins content of their products

B. Dry powdered orange albedo:

The substitution of WF by dry powdered orange albedo substituted at levels of 5, 10, and 15% , respectively, led to an increase in crude fiber content of fried noodles ,with the increase in substitution level, to values of 2.35, 3.1, and 3.9% ,respectively, in ALBEDO group made from 82 % ext. WF ; 1.32, 2.15, and 2.89%, respectively, in ALBEDO group made from 72 % ext. WF; and 1.13, 1.97, and 2.73% , respectively, in ALBEDO group made from 65% WF compared with the corresponding 82, 72 and 65 %WF noodle controls (1.6, 0.49, and 0.29%, respectively).

Ash content was also increased in orange ALBEDO noodles substituted at levels of 5, 10, and 15% ,respectively, but slightly with the increase in substitution level to 1.61 ,1.68, and 1.78 % ,respectively, in ALBEDO group made from 82 % ext. WF ; 0.81, 0.94, and 1.03 %, respectively, in ALBEDO group made from 72 % ext. WF; and 0.18, 0.91, and 1.1% , respectively, in ALBEDO

group made from 65% WF compared with the corresponding 82, 72 and 65 %WF noodle controls (1.5, 0.71, and 0.55%, respectively).

In an opposite direction, there was an decrease the crude protein content to 13.72, 13.64, and 12.73%, respectively, in ALBEDO group made from 82 % ext. WF ; 11.6 , 11.2 ; and 10.2 % in ALBEDO group made from 72 % ext. WF ; 11.15 , 10.73 and 10.0 % ,respectively, in ALBEDO group made from 65 % ext. WF compared with WF noodle controls that recorded 14.21, 12.2, and 11.5% , respectively.

Moisture content of ALBEDO fried noodles ranged between 4.21

to 6.33 % which was within the range of their corresponding 82, 72 and 65 %WF controls (6.0 , 6.0 and 5 3. % , respectively). In the same trend ,crude fats content of ALBEDO fried noodles which ranged between 18.8 to 20.96 % was within the range of their corresponding 82, 72 and 65 % ext. WF controls (19.5, 19.0 and 18.99 % , respectively).

Regardless of level of substitution, substituting of WF of 82, 72, and65% ext. rate by dry powdered orange albedo caused content of their resultant instant noodles to increase in crude fibers (between 2.35 to 3.9 %) and ash (between o.18 to 1.78 %) ,but crude proteins and total carbohydrates decreased .

These obtained data about orange albedo products confirmed the general trend noticed by **Abu El-Maati (1999) and Doweidar (2001)** who studied the effect of supplementing orange albedo on the chemical composition of Egyptian baked products. **Keresz (1951)** and **Grohmann *et al.* (1995)** found that the dry powdered orange albedo layer contained high crude fibers.

C. Corn flour(CF)

The substitution of WF by corn flour at levels 10, 20 and 30 % ,respectively, increased the fried noodle content in total carbohydrates with the increase in substitution level, to 60.92, 61.7 and 63.97 respectively, in the CF noodles made from 82 % ext. WF; 61.0, 65.0 and 65.31 respectively, in the CF group made from 72 % ext. WF ; 63.34, 65.15 and 65.5 %, respectively, in the CF group made from 65 % ext. WF) compared to their corresponding 82, 72 and 65 % ext. WF noodle controls (57.2, 61.09, and 63.36 % ,respectively). The increase in total carbohydrates parallel to the increase substitution level was more manifested in the CF noodles made from 65 and 72% ext. WF.

The substitution of WF by corn flour at levels 10, 20 and 30 % ,respectively, increased the fried noodle content in crude fibers with the increase in substitution level, to 1.7, 1.87, 2.00, respectively, in the CF group made from 82 % ext. WF; 0.75, 0.99, 1.33 , respectively, in the CF group made from 72 % ext. WF ; 0.57, 0.84, and 1.1%, respectively, in the CF group made from 65 % ext. WF) compared to their corresponding 82, 72 and 65 % ext. WF noodle controls (1.6, 0.49, and 0.29% ,respectively).

All the corn flour group treatments showed lower contents in crude proteins (which ranged between 11.6 to 10.95 %, 11.65 to 10.95 % and 11.15 to 10.7 %) and ash (which ranged between 1.48 to1.44 %, 0.74 to 0.84% and 0.71 to 0.82 %) compared to their corresponding 82, 72 and 65 % ext. WF noodle controls which exhibited higher values (14.21,12.21 and 11.51% , respectively, for crude protein content and 1.50,0.71 and 0.55 % ,respectively, for ash content.

Moisture content of CF fried noodles ranged between 4.21 to 6.0 % which was within the range of their corresponding 82, 72 and 65 %WF controls (6.0 , 6.0 and 5 3. % , respectively). In the same trend, crude fats content of CF fried noodles which ranged between 16.2 to17.96 % was within the range of their corresponding 82, 72 and 65 %WF controls (19.5,19.0 and 18.99 % , respectively).

In general, it was observed that the substitution of WF of 82, 72, and 65% ext. rate by corn flour ,regardless of level of substitution. resulted in increasing the content of the resultant instant fried noodles in total carbohydrates and crude fibers ,but an decrease in their content of crude proteins , and ash.

These obtained results for CF noodles are in same trend with the data found by **Kamal (1998)** who reported that replacement of corn flour for exchange for wheat flours in making macaroni lead to increasing the fibers percentage of all samples tested .

D. Dry powdered beet roots (BR):

Substitution of WF by 4, 6, and 8% of dry powdered beet roots ,respectively , increased ash content in instant fried noodles (1.7, 1.76, and 1.80% ,respectively ,in the BR group made from 82 % ext. WF; 0.87, 0.96, and 1.2 %,respectively, in the BR group made from 72 % ext. WF and 0.83, 0.94, and 1.03%, respectively ,in the BR group made from 65% ext. WF) compared with the corresponding 82 , 72 and 65% ext. WF fried noodles controls (1.5, 0.71 and 0.55%, respectively).

In contrast , substituting of wheat flours by dry powdered beet roots decreased the crude protein content in all the three BR

levels tested (13.7, 13.4, 13.2 ,respectively ,in the BR group made from 82 % ext. WF ; 11.5, 11.3 and 11% ,respectively ,in the BR group made from 72 % ext. WF; and 11.13, 10.87, and 10.66%,respectively ,in the BR group made from 65 % ext. WF) compared with the corresponding 82 , 72 and 65% ext. WF fried noodles controls (14.2, 12.2, and 11.5 %, respectively)

Moisture content of BR fried noodles ranged between 4.23 to 6.01 % which was within the range of their corresponding 82, 72 and 65 %WF controls (6.0 , 6.0 and 5 3. % , respectively). In the same trend, crude fats content of BR fried noodles which ranged between 17. to 20.16 % was within the range of their corresponding 82, 72 and 65 %WF controls (19.5,19.0 and 18.99 % , respectively).

In general, from tables 23, 24 and 25it was observed that the substitution of WF of 82, 72, and 65% ext. rate by beet roots ,regardless of level of substitution. resulted in increasing the content of the resultant instant fried noodles in ash and crude fibers (between 0.83 to 1.80 %),but an decrease in their content of crude proteins (between 11.13 to 13.7%) .

These results for BR noodles were in with those reported by **(Galila 2000)** about the effect of addition of beet roots on the chemical composition of Egyptian Marconi products.

Crude fats and moisture content of fried noodles decreased with the inclusion regardless of the kind of substitution and with increasing substitution levels . These results may be due to the fact that frying process removed the water content of noodles doughs and also incorporated the oil of frying into the noodle (**Kim, 1996**). Similar findings were also found by **(Kim and Lee 1990)** who

found that the moisture and lipid content decreased after preparation of fried Asian noodles.

Generally speaking , based on data of chemical composition of experimental noodles ,the substitution of wheat flours by dry powdered beet roots at only 4% , okara flour or orange albedo at only 5% as well as corn flour at only 10% markedly changed the chemical composition of the prepared instant noodles where they caused an increase in crude proteins, crude fibers, and ash contents. The rate of increase in these chemical constituents was much intense with the increase in substitution level of WF by the four substitutes in fried noodles. Regardless of the substitution level, okara fried noodles were characterized by the highest crude proteins content , while orange albedo were characterized by highest crude fibers content , corn flour were characterized by highest total carbohydrates content, and beet roots increased were characterized by highest ash content.

4.7. Study of the effect of wheat flour extraction rate, kind and substitution level of some natural products on essential mineral content of the experimental instant noodles:

Determination of the macro elements K, Ca , Mg and Na as well as the microelements Fe, Cu, Mn and Zn by the spectrophotometric method and P by chemical method was performed on ash of the starting wheat flours of various extraction rates (82, 72, and 65% ext.) , natural substitutes (OF , ALBEDO , CF and BR) and their experimental noodles fried at 180-185 C^{o} for 40-45 sec , where analyses are presented in tables 24 ,25 and 26 and illustrated in figure 11 and 12.

4.7.1. Essential mineral matter content of the starting wheat flours of variable extraction rates:

The essential mineral matter content of wheat flours of various extraction rates (82, 72, and 65% ext.) as well as the effect of using these different WF on mineral matter content of their experimental instant noodles fried at 180-185°C for 40-45 sec. are demonstrated in tables 24 ,25and 26 illustrated in figure 13and 14.

From the results presented in table (24), it could be noticed that wheat flour 82% extraction contained the highest mineral matter content compared with both 72% and 65% ext. wheat flours. However, the three wheat flours was contained appreciable high amount of potassium, magnesium and phosphorus.

Regardless of the extraction rate of WF, potassium constituted the major essential element in all the WF of 82%, 72% and 65% ext. (219, 120 and 98 mg/100g , respectively). Regardless of the WF ext. rate, essential macro minerals in the three WF tested were ranked , in order of decreasing abundance , as follows : potassium, magnesium ,phosphorus, calcium and finally sodium ; while micro elements were ranked as follows : zinc ,manganese , iron and copper.

4.7.2. Effect of kind of natural substitutes on essential mineral content of the experimental instant noodles:

Appreciable concentrations of some mineral elements were found in all the natural substitutes analyzed compared to the WF flours. However, great variation were observed in concentrations of the all analyzed essential elements present in okara and beet roots flours, but their mode of distribution or

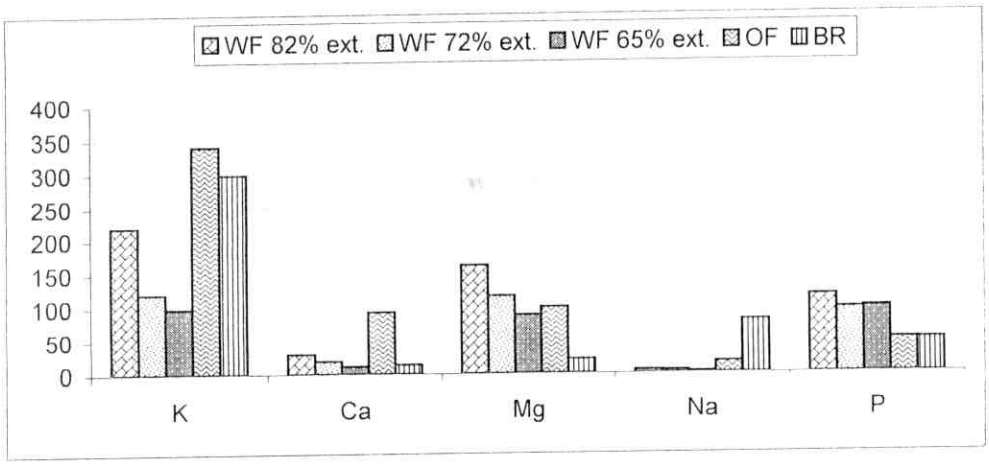
ranking of their microelements, only ,was similar which was not the case with their macro elements.

Regardless of the substitution level, essential macro minerals in okara group noodles were ranked , in order of decreasing abundance , as follows , potassium, magnesium, phosphorus, calcium and finally sodium while microelements were ranked , in order of decreasing abundance, zinc, followed by manganese then iron and finally copper.

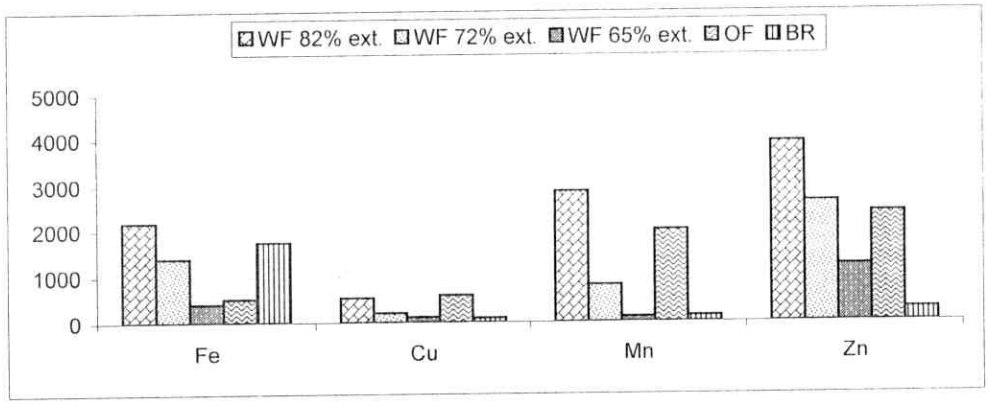
Essential macro minerals in beet roots flour ranked , in order of decreasing abundance , as follows : K (298.1 mg%), Na (78.8 mg%) , P (49.99 mg%) , Mg (21.5 mg%) and finally Ca (13.7 mg%) while microelements were ranked as follows : Fe (0.74 mic.g %) , Zn (0.29 mic.g %) Mn(0.13 mic.g %) and Cu (0.10 mic.g %)

Table(24): Mineral content of starting wheat flours and other natural sources (mg/l00g on dry weight basis) used in the preparation of instant noodles.

Mineral	Wheat flour (82% ext.)	Wheat flour (72% ext.)	Wheat flour (65% ext.)	Okara flour group	Powdered beet roots
Macro elements:					
Potassium	219.3	120.3	98.1	340	298.1
Calcium	30.2	19.1	11.3	93	13.7
Magnesium	160.85	115.4	87.4	99	21.5
Sodium	4.6	4.1	2.4	17	78.8
Phosphorus	113.70	96.51	95.17	50.3	49.9
Microelements					
Iron	2.18	1.29	0.41	3.2	1.74
Copper	0.541	0.213	0.120	0.60	0.10
Manganese	2.88	0.81	0.11	2.01	0.13
Zinc	3.94	2.65	1.23	2.40	0.29



Fig(13): Essential macro elements of the mineral content (mg/ 100g on dry weight basis) of the materials used in the preparation of instant noodles [**A**: Wheat flours (WF) of 82, 72 and 65% ext. **B:** Okara flour (OF) and **C:** Beet roots (BR)] .



Fig(14): Essential microelements of the mineral content (microgram / 100g on dry weight basis) of the materials used in the preparation of instant noodles [**A**: Wheat flours (WF) of 82, 72and 65% ext. **B:** Okara flour (OF) and **C:** Beet roots (BR)] .

Table (25):Mineral content of noodles produced from wheat flours (82% , 72% and 65% extractions) when substituted by different levels (10 and 15%) of okara flour.

Mineral %	Wheat flour (82% ext.) Level of substitution			Wheat flour (72% ext.) Level of substitution			Wheat flour (65% ext.) Level of substitution		
	0 (Control)	10	15	0 (Control)	10	15	0 (Control)	10	15
Macro elements									
Potassium	219	231	237	118.0	142	153	95.0	122.2	126.6
Calcium	30.1	36.3	38.9	18.9	26.4	30.05	11.2	19.38	23.42
Magnesium	159.4	154.4	151.1	115.0	113.58	112.75	87.0	88.38	83.90
Sodium	4.3	7.3	6.2	3.8	5.30	5.10	2.3	3.68	3.57
Phosphorus	113.70	107.33	104	96.51	91.5	89.27	95.17	90.53	88.25
Microelements									
Iron	2.13	2.27	2.32	1.2	1.46	1.56	0.35	0.68	0.82
Copper	0.5	0.54	1.35	0.211	0.25	1.08	0.120	0.17	1.00
Manganese	2.6	2.79	2.75	0.75	0.92	0.96	0.110	0.30	0.39
Zinc	3.7	3.54	3.46	2.46	2.49	2.5	1.13	1.08	1.30

ext.; 142 and 153 mg/100g , respectively) in the noodles prepared from WF 72% ext. ;and 122.2 and 126.6 mg/100g , respectively) in the noodles prepared from WF 65% ext.group). Each 100 gm dry samples of noodles prepared from10 and 15% level of okara contained higher potassium concentrations compared to their corresponding 82 ,72 and 65 % ext. WF noodle controls (219, 118 and 95 mg/100g , respectively).

Each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained higher calcium concentrations (36.3 and 38.9 mg/100g, respectively, in the OF group made from 82 % ext.; 26.4 and 30.05 mg/100g, respectively, in the OF group made from 72 % ext and 19.38 and 23.42 mg/100g, respectively, in the OF group made from 65 % ext; compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (30, 18.9 and 11.2 mg/100g, respectively).

Among the macro elements, sodium was present in the lowest concentration, in the 10 and 15% okara noodle group (7.3 and 6.2 mg/100g , respectively, in the noodles prepared from WF 82% ext.; 5.3 and5.1 mg/100g , respectively, in the noodles prepared from WF 72% ext, and 3.68 and 3.57 mg/100g , respectively, in the noodles prepared from WF 65% ext). However, each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained higher Na concentrations compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (0.5, 0.2 and 0.120 mic.g./100g, respectively).

In contrast, each 100 gm dry samples of 10 and 15% level of okara noodles contained lower magnesium concentrations (154.4 and 151.1 mg/100g, respectively, in the OF group made from 82 % ext.; 113.58 and 112.72 mg/100g, respectively in the OF group

made from 72 % ext.; and 88.38 and 83.9 mg/100g , respectively, in the OF group made from 65 % ext compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls 159.4, 115.0 and 87.0 mg/100g , respectively).

Similar to magnesium pattern, each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained lower phosphorus (107.33 and 104 mg/100g, respectively, in the OF group made from 82 % ext ; 91.5 and 89.27 mg/100g , respectively, in the OF group made from 72 % ext and 90.5 and 88.25 mg/100g , respectively, in the OF group made from 65 % ext. compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (113.7, 96.5 and 95.17 mg/100g , respectively).

With respect to microelements, each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained higher iron concentrations (2.3 and 2.32 mic.g /100g, respectively, in the OF group made from 82 % ext.; 1.48 and 1.54 mic.g /100g, respectively, in the OF group made from 72 % ext; and o.68 and 0.82 mic.g /100g, respectively, in the OF group made from 65 % ext., compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (2.13, 1.2 and 0.35 mic.g /100 g, respectively).

Similarly, each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained higher manganese concentrations (2.79 and 2.75 mic.g /100g , respectively, in the OF group made from 82 % ext; 0.92 and 0.96 mic.g /100g , respectively, in the OF group made from 72 % ext ; and 0.3. and.0.39 mic.g /100g , respectively) in the OF group made from 65 % ext compared to their corresponding 82 ,72 and 65 %ext.WF noodle controls (2.6, 0.75 and 0.11 mic.g/100g , respectively).

In addition, each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained lower zinc concentrations (3.54 and 3.46 mic.g/100g in the OF group made from 82 % ext ; 2.49 and 2.5 mic.g/100g, respectively, in the OF group made from 72 % ext. and 1.08 and 1.30 mic.g/100g, respectively, in the OF group made from 65 % ext., compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (3.7, 2.46 and 1.13 mic.g/100g , respectively).

Among the microelements, Cu was found in the lowest concentration (0.54 and 1.35 mic. g /100g, respectively) in the noodles prepared from WF 82% ext ; 0.25 and 1.08 mic.g /100g , respectively, in the noodles prepared from WF 72% ext ; and (0.17 and 1.0 mic. g /100g) , respectively, in the noodles prepared from WF 65% ext. However, each 100 gm dry samples of noodles prepared from 10 and 15% level of okara contained higher copper concentrations compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (0.5, 0.2 and 0.120 mic.g./100g, respectively).

B. Dry powdered beet roots :

Regardless of the substitution level, essential macro minerals in beet roots group noodles were ranked , in order of decreasing abundance , as follows : K, Mg, P, Ca and finally Na; while microelements were ranked , in order of decreasing abundance, Zn followed by Mn then Fe and finally Cu.

The inclusion of beet roots in noodles , regardless of its substitution level, resulted in higher concentrations of K , Na and Mn, but lower concentrations of Mg, Ca, P, Fe ,Cu, and Zn compared to WF 82 %control noodles ; higher concentrations of K, Na, Mn ,but lower Mg, Ca, P, Fe, Cu and Zn compared to WF 82 %control noodles ; and higher concentrations of K and Na

, but lower Mg, Ca, P, Fe, Mn, Cu and Zn compared to WF 82 %control noodles.

Each 100 gm dry samples of noodles prepared from substituting wheat flours (82%, 72% and 65% ext.) by different levels of beet roots (4, 6 and 8%) contained higher K concentrations (222.3, 223.8 and 224.6 mg/100g, respectively, in the BR group made from 82 % ext. ; 127.1, 130.7 and 134.2 mg/100g , respectively, in the OF group made from 72 % ext.; and 105.9, 109.8 and 113.8 mg/100g , respectively, in the OF group made from 65 % ext.) compared to their corresponding 82 ,72 and 65 % ext. WF noodle controls (219, 118 and 95 mg/100g , respectively).

Each 100 gm dry samples of noodles prepared from substituting wheat flours (82%, 72% and 65% ext.) by different levels of beet roots (4, 6 and 8%) contained higher Na concentrations (7.4, 8.85 and 10.3 mg/100g , respectively, in the OF group made from 82 % ext.; 6.9, 8.35 and 9.8 mg/100g sodium, respectively, in the BR group made from 72 % ext.; and 5.3, 6.81 and 8.3 mg/100g, respectively, in the BR group made from 65 % ext) compared to their corresponding 82 ,72 and 65 %ext. WF noodle controls (4.3, 3.8 and 2.3, mg/100g , respectively).

Each 100 gm dry samples of noodles prepared from substituting wheat flours (82%, 72% and 65% ext.) by different levels of beet roots (4, 6 and 8%) contained higher Mn concentrations (2.734, 2.70 and 2.61 mic.g /100g , respectively, in the BR group made from 82 % ext. ; 0.77, 0.74 and 0.70 mic.g 100g , respectively, in the BR group made from 72 % ext.); but lower Mn amount (0.11, 0.10 and.0.10 mic.g /100g , respectively), in the BR group made from 65 % ext. compared to their

corresponding 82 ,72 and 65 %ext. WF noodle controls (2.6, 0.65 and 0.11, 115 and 107 mic.g /100g, respectively).

From the previous results (table 26 ,27 and 28), the observed finding that as wheat flours extraction rate increases ,there was a parallel increase in the minerals content of their corresponding prepared instant noodles. This might be due to the high amounts of bran present in WF of high extraction rate than that present in WF of low extraction rate. Similar findigs were demonstrated by **O' Dell *et al.* (1982)** who found that the major concentration of elements in wheat was found in bran and middling fractions. Furthermore , **Mousa *et al.* (1989)** stated that ash content increased as flour extraction increased. In addition, **Ranhotra *et al.*(1994)** reported that bran is a rich source of calcium, magnesium potassium and phosphorus.

In general , from these obtained data of the present study , it could be stated that wheat flours contained the highest amount of potassium, magnesium ,phosphorus, manganese and zinc , okara flour contained the highest amount of potassium and iron while dry powered beet roots contained the highest amount of sodium. On the other hand, wheat flours contained the lowest concentrations in sodium and calcium, okara flour contained the lowest concentrations in phosphorus, while dry powdered beet roots contained the lowest concentrations in magnesium, copper, manganese, zinc and Iron.

However, the obtained results of mineral matter content confirmed those obtained by **Lorenz *et al.* (1980)** who reported that wheat flours contained more amounts of zinc and iron than dry powdered beet roots. The finding that potassium, calcium

magnesium and sodium were abundant in beet roots are in close agreements with those obtained by **Galila (200)** for beet roots.

4.8. Study of the effect of wheat flour extraction rate ,kind and substitution level of some natural products on organoleptic properties of the experimental instant noodles.

The organoleptic properties of fried instant noodles produced from wheat flours (82, 72, and 65% ext.).and their corresponding noodles groups which were substituted by different levels of natural substitutes (okara flour, dry powdered orange albedo, corn flour group, and dry powdered beet roots) were determined. Fried noodles prepared from WF substituted by 20% okara flour were excluded from testing because of its observed oily taste and flavor. The samples were evaluated organoleptically by ten panelists for their appearance, color, flavor, tenderness, and stickiness where scores were given and their mean values were statistically analyzed using analysis of variance and least significant difference (LSD), as presented in tables (27,28 and 29).

4.8.1. Effect of wheat flour extraction rate on the organoleptic properties of experimental instant noodles:

The organoleptic properties of fried instant noodles processed from only wheat flours of 82%, 72%, and 65% ext. are illustrated in tables 27, 28 and 29 and illustrated in Fig. 15 and 16.

Generally speaking ,it could be noticed that noodles made from wheat flour 65% extraction had the highest scores for all the organoleptic properties examined followed by those made from wheat flour 72% ext. then finally wheat flour those made from 82%

ext., which exhibited the lowest given scores. However, the three noodle samples made from 82 ,72 and 65% WF extraction rates did not differ significantly in scores given for most organoleptic properties.

4.8.2. Effect of kind and level of natural substitutes on the organoleptic properties of experimental instant noodles:

The organoleptic properties of fried instant noodles produced from wheat flours (82, 72, and 65% ext.) and their corresponding noodles groups substituted by different levels of okara (5,10 and 15 % OF), dry powdered orange albedo (5,10 and 15 % ALBEDO), corn flour (10, 20 and 30 % CF) and dry powdered beet roots (4,6 and 8 %BR) are tabulated in table 27, 28 and 29.

Results in tables 27, 28 and 29 show that no significant difference in appearance ,tenderness and stickiness scores between noodles processed from 82,72 and 65 % ext. wheat flours or those substituted noodle treatments prepared with okara flour group, orange albedo at all substitution levels. Meanwhile, a highly significant differences in appearance were noticed between treatments 20 and 30% corn flour, 4, 6, and 8% dry powdered beet roots.

Form the same tables, no significant difference in the color of noodles processed from wheat flours 82 and 65 % ext. and okara flour group or dry orange albedo group or 10 and 20 %CF, but highly significant differences were noticed in the color values of controls noodles and their corresponding samples of the dry powdered beet roots group.

Table (27): Effect of substituting 82% extraction wheat flour (WF) by okara dry flour (OF), dry powdered orange albedo (ALBEDO), corn flour (CF) and dry powdered beet roots (BR) to on the sensory evaluation test for experimental instant noodles.

Treatment	Scores for sensory evaluation						
	Sample No.	Appearance 20	Color 20	Tenderness 25	Flavor 20	Stickiness 15	Overall acceptability 100
Wheat flour of 82% extraction	1	16.40 ^{a}	16.2^{a}	19.5^{a}	14.00^{a}	11.8^{a}	77.3^{a}
Okara dry flour group	2	15.70^{a}	15.9^{a}	19.1^{a}	12.31^{b}	10.00^{b}	73.01^{bc}
	3	15.00^{a}	16.00^{a}	19.00^{a}	12.20^{b}	10.1^{b}	72.21^{c}
	4	14.8^{a}	15.7^{a}	18.6^{b}	12.01^{b}	10.2^{b}	71.31^{c}
Dry powdered orange abiedo	5	15.30^{a}	16.00^{a}	19.9^{a}	14.10^{a}	11.99^{a}	77.3^{a}
	6	14.30^{a}	16.00^{a}	19.5^{a}	13.00^{b}	11.00^{a}	77.3^{b}
	7	14.1^{b}	15.8^{a}	19.01^{a}	11.7^{b}	10.8^{b}	71.4^{b}
Corn flour group	8	13.9^{b}	15.3^{b}	18.8^{b}	11.20^{c}	9.71^{b}	68.9^{b}
	9	12.6^{c}	15.00^{b}	18.5^{b}	12.00^{c}	10.5^{b}	68.5^{a}
	10	12.00^{c}	14.6^{b}	18.00^{b}	12.11^{bc}	10.7^{b}	67.4^{c}
Dry powdered beet root group	11	11.00^{c}	14.5^{b}	18.00^{b}	13.07^{b}	11.10^{a}	67.6^{c}
	12	10.00^{d}	14.2^{c}	17.4^{c}	12.13^{b}	11.6^{a}	65.33^{c}
	13	9.9^{d}	13.8^{c}	16.00^{d}	11.16^{c}	10.5^{b}	65.16^{d}
	LSD	2.31	0.912	1.12	1.01	0.972	3.12

* Values of similar superscripts are significantly not different at probability < 0.5 %

From the previous results, it could be concluded that the color of all cooked instant fried noodles tended to decrease significantly with increasing the substitution level of BR and CF during making noodles

On the other hand, it could be noticed that no significant differences in the flavor scores given for cooked noodles processed from wheat flour 72 and 65% ext. control group or for their corresponding treatments substituted by okara and dry orange albedo groups ,but this was not the case with respect to the 82%WF control noodles which were significantly different.. Furthermore, there were significant differences between the flavor scores of noodles processed from wheat flour 82% extraction and all the other treatments.

From the obtained data, it could be noticed that no significant differences in the flavor scores given for cooked noodles processed from wheat flour 72 and 65% ext. control group or for their corresponding treatments substituted by okara and dry orange albedo groups ,but this was not the case with respect to the 82%WF control noodles which were significantly different.. Furthermore, there were significant differences between the flavor scores of noodles processed from wheat flour 82% extraction and all the other treatments.

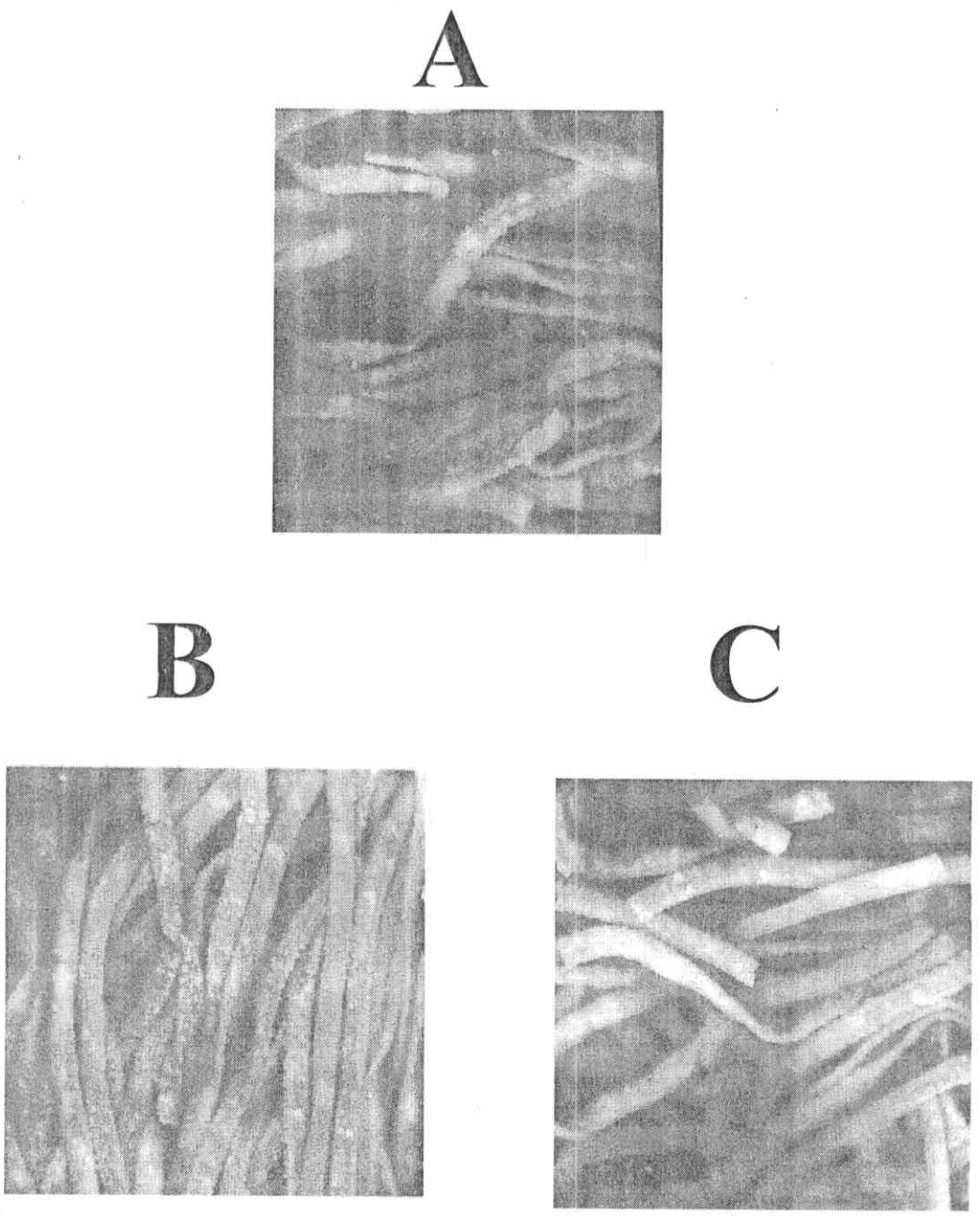


Fig (15): Photographs for the instant noodles prepared from A: Wh flour 82% ext. ; **B**: Wheat flour 72 % control and **C**: Wheat fl 65% WF control

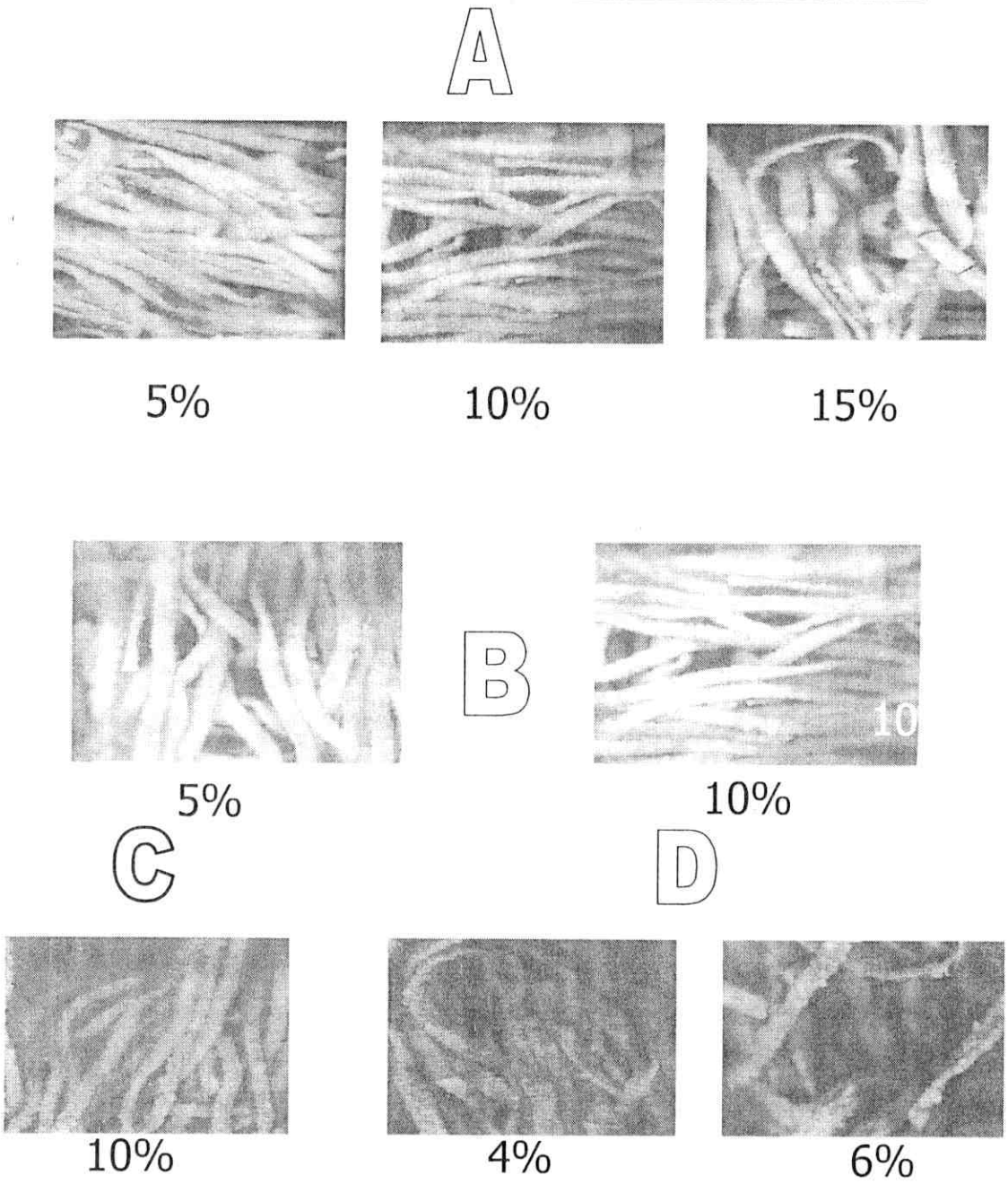


Fig. (16): Photographs for the instant noodles prepared using some natural substitutes of [A: Okara flour (OF); B: Dry orange albedo (ALPEDO); C: Corn flour and D: Beet root (BR).

These results agree with those of **Kordonowy and Young (1985)** who reported that flavor, texture and color scores of the noodles no significantly was rated higher than all other samples. All color scores were significantly different and color scores 10, 20, and 30% corn flour were less than the 4, 6, and 8% dry powdered beet roots.

From the same tables , no significant differences were noticed in stickiness scores for instant fried noodles from wheat flour 82% extraction and their corresponding substituted treatments. These results were also agreed with those reported by **Abo- El- Naga (1995).**

Concerning the tenderness of cooked instant fried noodles, the obtained results indicated that substitution of okara flour group and dry powdered orange albedo of wheat flour 82% ext. group had no effect on the noodles tenderness. Meanwhile, in creasing the substitution of dry powdered orange albedo to 10-15% , the tenderness of the cooked noodles was greatly affected, where highly significant differences were noticed between control 82%WF sample and other treatments.

Theses obtained results are in agreement with those obtained by **Abo–El-Naga (1995)** who studied the substitution of wheat flour by dietary fiber in spaghetti products and found that substitution up to 5% of Albedo as a fiber source achieved the best organoleptic results.

In general, from the obtained results , it could be observed that no significant differences was found between noodles samples made from the wheat flour controls and their corresponding noodles

made from the substituted materials for scores given for appearance, tenderness, stickiness , but significant differences were found in scores given for color and flavor.

4.9. Effect of storage time and types of packaging materials on shelf–life and oil stability parameters of the experimental instant fried noodles as influenced by kind and substitution level of some natural products:

The storage stability parameters of instant noodles prepared from wheat flour of 72% ext. as well as those prepared using different natural substitutes (OF, ALBEDO, CF and BR) when packaged and stored for period up to five months at ambient room temperature and in dark room were explored. The experimental instant fried noodles were packaged in three types of packaging materials, i.e., metalized oriented polypropylene (MOPP), polypropylene oriented (PPO), and polyethylene (PE) then stored for 5 months under room temperature. Some storage stability parameters such as , acid value (AV.), and peroxide value (PV.) content in oils of fried noodles, were determined before storage (at zero time)as well as after one ,three and five months of storage and the obtained results are presented in tables (30 and 31) and illustrated in figs (17,18,19,20,21,22.23 and24).

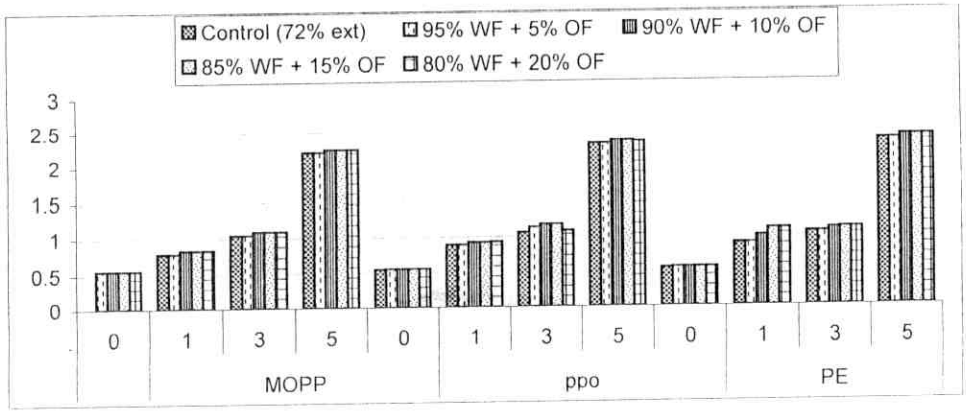
4.9.1. Effect of time of storage on oil stability parameters of experimental stored instant noodles prepared from wheat flour

Data presented in tables (30) and illustrated in fig. (17,18,19 and 20) indicated that the acid value of instant fried noodles prepared from wheat flours of 72 % extraction then packaged in MOPP, PPO,

Table (30): Effect of storage conditions on the acid value of instant noodles prepared from 72%extraction wheat flour substituted by different levels of various additives when packaged in different types of packaging materials and stored at room temperature for five months.

Experimental blends used to prepare noodles	Sample	Packaging materials											
		Metalized oriented polypropylene (MPP)				Polypropylene oriented (PPO)				Poiyethylene (PE)			
		Month				Month				Month			
		Zero time	1	3	5	Zero time	1	3	5	Zero time	1	3	5
Control group wheat flour (72% extraction)	1	0.55	0.80	1.04	2.21	0.55	0.89	1.06	2.32	0.55	0.90	1.09	2.37
Okara dry flour group (OF)													
95% WF + 5% OF	2	0.56	0.80	1.04	2.21	0.56	0.89	1.13	2.32	0.56	0.90	1.05	2.37
90% WF + 10% OF	3	0.56	0.84	1.09	2.25	0.56	0.92	1.17	2.36	0.56	1	1.10	2.42
85% WF + 15% OF	4	0.56	0.84	1.09	2.25	0.56	0.92	1.17	2.36	0.56	1.1	1.11	2.43
80% WF + 20% OF	5	0.56	0.84	1.09	2.25	0.56	0.93	1.08	2.35	0.56	1.1	1.11	2.47
Dry powdered orange albedo group (ALBEDO)													
95% WF +5% ALBEDO	6	0.56	0.81	1.05	2.24	0.56	0.90	1.04	2.35	0.56	0.92	1.07	2.40
90% WF + 10% ALBEDO	7	0.56	0.81	1.04	2.23	0.56	0.89	1.03	2.32	0.56	0.91	1.05	2.43
85% WF + 15% ALBEDO	8	0.56	0.82	1.06	2.25	0.56	0.89	1.03	2.36	0.56	0.93	1.07	2.47
Corn flour group (CF)													
90% WF + 10% CF	9	0.53	0.78	1.00	2.08	0.53	0.86	1.00	2.26	0.53	0.85	1.00	2.30
80% WF + 20%CF	10	0.52	0.78	1.00	2.08	0.52	0.86	1.00	2.26	0.52	0.88	1.03	2.30
70% WF + 30% CF	11	0.52	0.77	1.22	2.16	0.52	0.85	1.21	2.24	0.52	0.88	1.03	2.35
Dry powdered beet roots (BR)													
96% WF +4% BR	12	0.55	0.78	1.00	2.0	0.55	0.86	1.00	2.26	0.55	0.88	1.30	2.30
94% WF +6% BR	13	0.55	0.79	1.01	2.11	0.55	0.87	1.10	2.28	0.55	0.89	1.21	2.35
92% WF +8% BR	14	0.56	0.79	1.01	2.11	0.56	0.87	1.21	2.28	0.56	0.89	1.31	2.36

• Average of three trials



(17) : Effect of storage conditions on the acid value of instant noodles prepared from 72 % extraction wheat flour (WF) when substituted by different levels of okara flour (OF), packaged in different types of packaging materials and stored at room temperature for five months (MOPP : metalized oriented polypropylene; **PPO:** polypropylene oriented; **PE:** polyethylene **).**

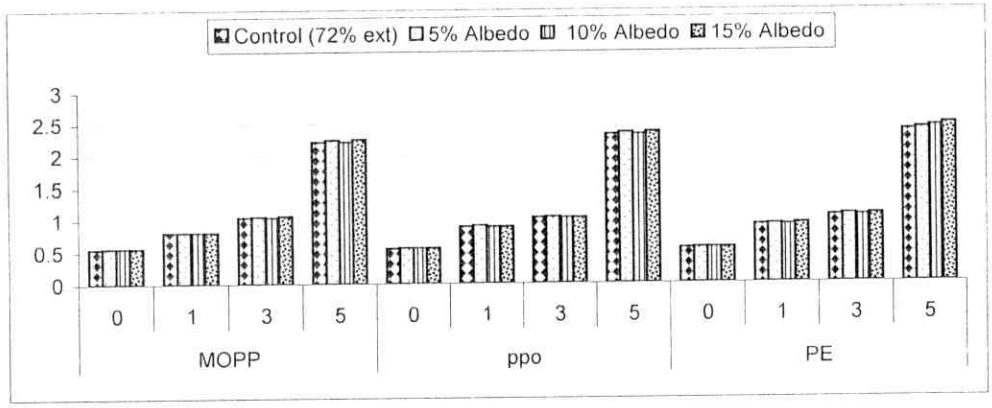


Fig (18) : Effect of storage conditions on the acid value of instant noodles prepared from 72 % extraction wheat flour (WF) when substituted by different levels of albedo flour of orange peels (ALBEDO) , packaged in different types of packaging materials and stored at room temperature for five months (MOPP : metalized oriented polypropylene; **PPO**: polypropylene oriented; **PE** : polyethylene).

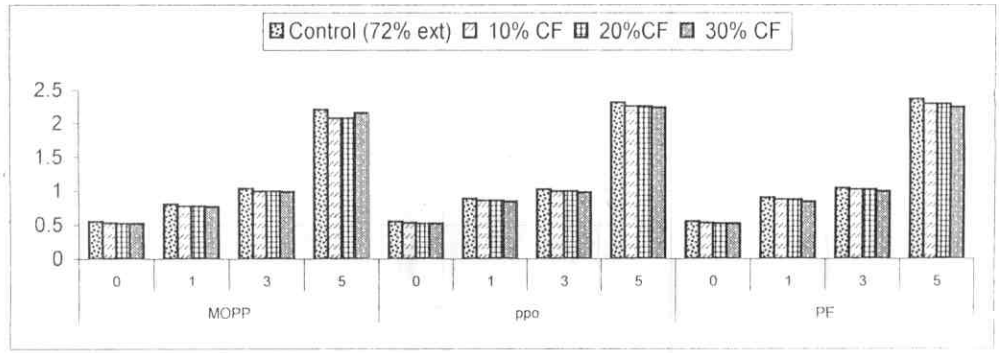


Fig (19) : Effect of storage conditions on the acid value of instant noodles prepared fron 72 % extraction wheat flour (WF) when substituted by different levels of corı flour (CF) , packaged in different types of packaging materials and stored a room temperature for five months (MOPP : metalized oriented polypropylene **PPO:** polypropylene oriented and **PE :** polyethylene **).**

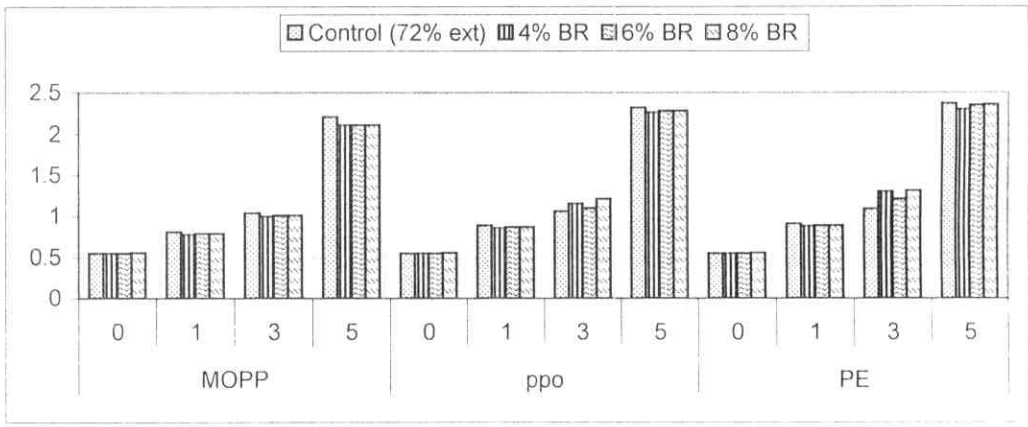


Fig (20) : Effect of storage conditions on the acid value of instant noodles prepared from 72 extraction wheat flour (WF) when substituted by different levels of Dry powdei beet roots (BR), packaged in different types of packaging materials and stored room temperature for five months (MOPP : metalized oriented polypropylene ; **PP** polypropylene oriented and **PE :** polyethylene **).**

and (PE) films and stored at room temperature for five months increased from 0.56 mg KOH / 1 gm. oil before storage (zero time)in the three packages , respectively , to values of 0.80 ,1.04 and 2.21 mg KOH / 1 gm. oil after one month of storage then increased to values of 0.89 ,1.03 and 2.32 mg KOH / 1 gm. oil after three months of storage and also increased to values of 0.90 , 1.05 and 2.37 mg KOH / 1 gm. oil at the end of storage in room temperatures (5 months).

The results presented in tables (31) and illustrated in fig. (21,22, 23 and 24) indicated that the peroxide value of instant fried noodles prepared from wheat flours of 72 % extraction then packaged in MOPP, PPO , and (PE) films and stored at room temperature for five months increased from 0.56 m. eqv. peroxide /1000 gm. oil before storage (zero time)in the three packages , respectively , to values of 1.34, 2.23 and 2.80 0.56 m.eqv. peroxide /1000 gm. oil after one month of storage then increased to values of 5.36 , 5.99 and 7.11. m.eqv. peroxide / 1000 gm. oil after three months of storage and also increased to values of 8.11, 8.99, and 11.19. m.eqv. peroxide / 1000 gm. oil at the end of storage in room temperatures (5 months).

In general, both oil stability parameters were influenced by time of storage, regardless of variation in type of packaging materials ,where there was a gradual increase in acid and peroxide values with the increase in storage time of WF noodles stored from one to five months.

4.9.2. Effect of time of storage on oil stability parameters of experimental stored instant noodles as influenced by kind and level of natural substitutes:

A. Okara flour(OF) :

Acid value of instant fried noodles prepared from WF substituted by different levels of (5, 10, 15 and 20 %) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from 0.56 mg KOH/ 1gm oil before storage (zero time) to higher values.

Average acid values for the 5, 10, 15 and 20 % OF after one , three and five months of storage, respectively, in the three packages tested ranged between 0.80 to 0.84 ; 1.04 to 1.09 ; 2.21 to 2.25 mg KOH / 1gm oil , respectively, in the MOPP group ; between 0.89 to 0.93 ; 1.13 to 1.08 and 2.32 to 2.35 mg KOH / 1gm oil in the PPO group, respectively ; and between 0.90 to 1.1; 1.05 to1.11 and 2.37 to 2.42 mg KOH / 1gm oil in the PE group, respectively , compared to the 72 % WF stored control noodles (0.80 , 1.04 and 2.21 ; 0.89, 1.03, and 2.32 , 0.90, 1.05 and 2.37 mg KOH / 1gm oil , respectively).

Table (31) : Effect of storage conditions on the peroxide value of instant noodles prepared from 72% extraction wheat flour substituted by different levels of various additives when packaged in different types of packaging materials and stored at room temperature for five months.

Experimental blends used to prepare noodles	Sample No	Packaging materials											
		Metalized oriented polypropylene (MOPP)				Polypropylene oriented (PPO)				Polyethylene (PE)			
		Month				Month				Month			
		Zero time	1	3	5	Zero time	1	3	5	Zero time	1	3	5
Control group wheat flour (72% extraction)	1	0.56	1.34	5.36	8.11	0.56	2.23	5.99	8.99	0.56	2.80	7.11	11.19
Okara dry flour group (OF)													
95% WF + 5% OF	2	0.57	1.35	5.99	8.21	0.57	2.25	6.11	9.00	0.57	2.40	7.00	11.15
90% WF + 10% OF	3	0.57	1.35	6.11	8.23	0.57	2.20	6.02	9.01	0.57	2.35	7.01	11.12
85% WF + 15% OF	4	0.57	1.32	6.13	8.20	0.57	2.31	6.85	9.12	0.57	2.42	7.30	11.43
80% WF + 20% OF	5	0.57	1.36	6.15	8.22	0.57	2.28	6.30	9.11	0.57	2.45	7.5	11.18
Dry powdered orange albedo group (ALBEDO)													
95% WF +5% ALBEDO	6	0.57	1.30	5.5	8.00	0.57	2.30	6.4	9.01	0.57	2.90	7.11	11.00
90% WF + 10% ALBEDO	7	0.57	1.21	5.91	8.32	0.57	2.12	6.80	9.30	0.57	2.70	7.23	11.30
85% WF + 15% ALBEDO	8	0.57	1.30	5.80	8.40	0.57	2.33	6.52	9.17	0.57	2.97	7.70	11.15
Corn flourgroup (CF)													
90% WF + 10% CF	9	0.54	1.33	5.14	8.15	0.54	2.40	6.14	9.00	0.54	2.80	7.50	11.11
80% WF + 20%CF	10	0.54	1.43	5.23	8.15	0.54	2.51	6.70	9.21	0.54	2.70	7.93	11.23
70% WF + 30% CF	11	0.54	1.34	5.5	8.31	0.54	2.42	6.20	9.11	0.54	2.83	7.80	11.03
Dry powdered beet root (BR)													
90% WF +4% BR	12	0.55	1.12	5.05	8.10	0.55	2.30	6.00	9.20	0.55	2.70	7.30	11.01
94% WF+6% BR	13	0.55	1.25	5.81	8.21	0.55	2.23	6.12	9.11	0.55	2.60	7.29	1.12
92% WF +8% BR	14	0.55	1.35	5.18	8.22	0.55	2.35	6.31	9.39	0.55	2.87	8.40	11.18

*** Average of three trials**

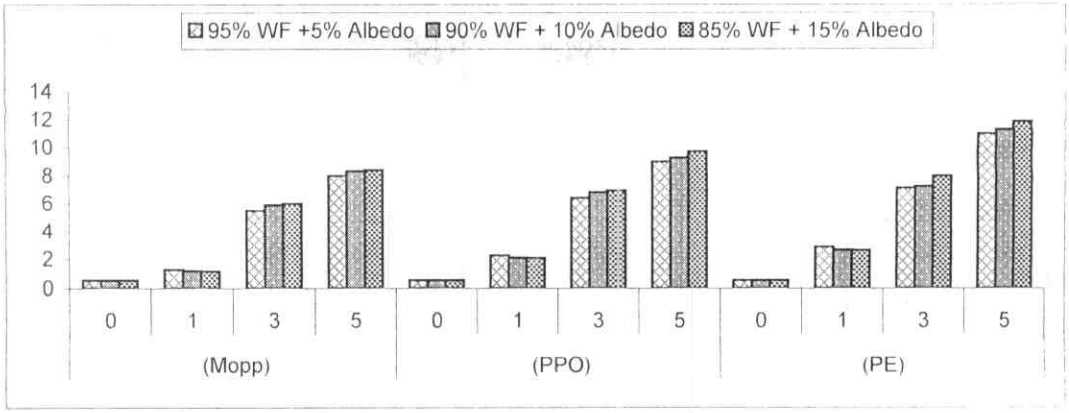


Fig (21): Effect of storage conditions on the peroxide value of instant noodles prepared fro 72% extraction wheat flour(WF) substituted by different levels of okara flo (OF) , packaged in different types of packaging materials and stored at roo temperature for five months (MOPP : metalized oriented polypropylene; **PP** polypropylene oriented; and **PE :** polyethylene **).**

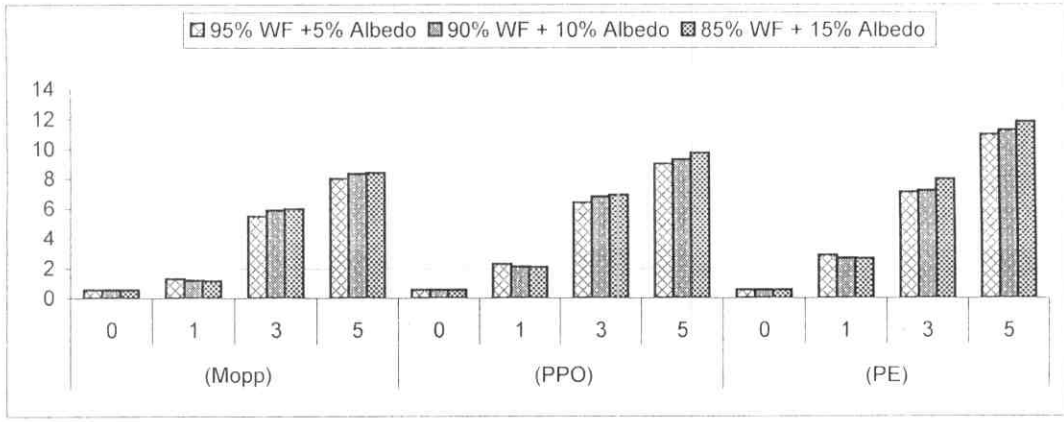


Fig (22) : Effect of storage conditions on the peroxide value of instant noodles prepar from 72% extraction wheat flour (WF) substituted by different levels of albe flour of orange peels (ALBEDO) , packaged in different types of packagi materials and stored at room temperature for five months (MOPP: metali oriented polypropylene ; **PPO :** polypropylene orinted ; **PE :** polyethylene**).**

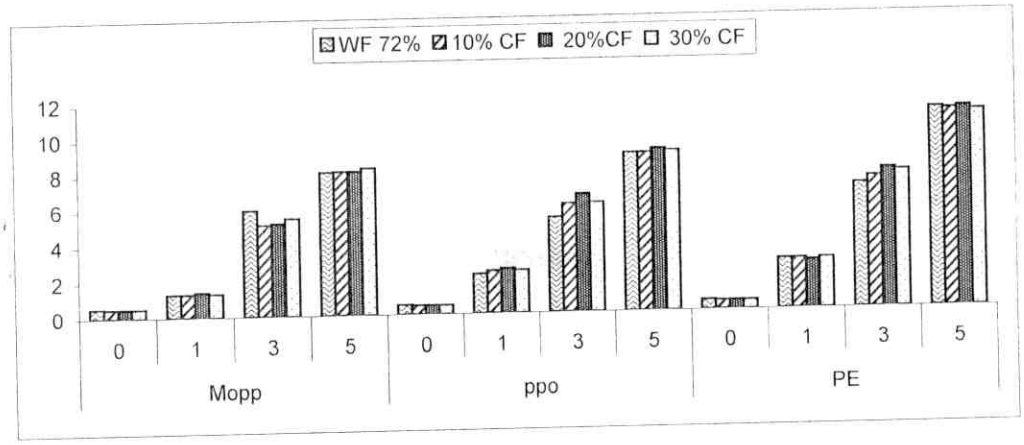
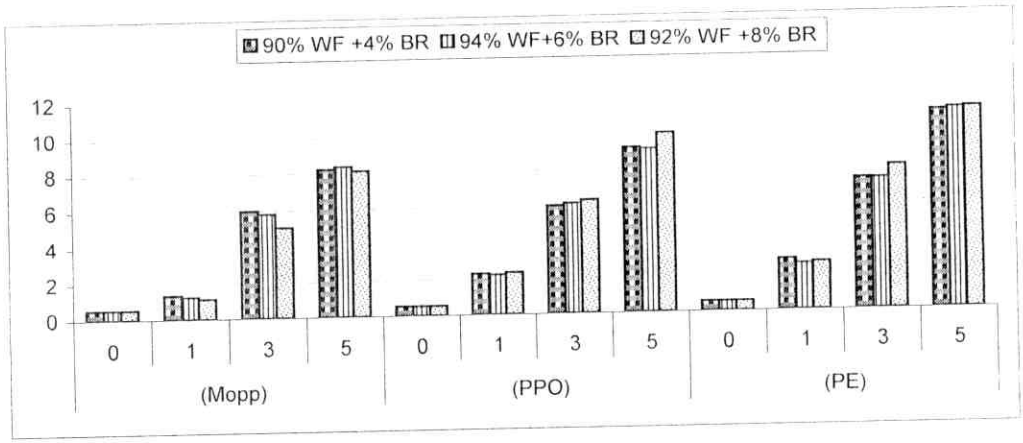


Fig (23): Effect of storage conditions on the peroxide value of instant noodles prepared from 72% extraction wheat flour (WF) substituted by different levels of corn flour (CF) , packaged in different types of packaging materials and stored at room temperature five months. (MOPP: metalized oriented polypropylene; **PPO**: polypropylene oriented ; and **PE :** polyethylene **).**



(24): Effect of storage conditions on the peroxide value of instant noodles prepared from 72% extraction wheat flour (WF) substituted by different levels of beet roots (BR), packaged in different types of packaging materials and stored at room temperature five months. (MOPP : metalized oriented polypropylene; **PPO:** polypropylene oriented; and **PE :**polyethylene**).**

Peroxide value for oils of instant fried noodles prepared from WF by different levels of OF (5, 10. 15 and 20 %) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from 0.56 m.eqv. peroxide /1000 gm oil before storage (zero time)to higher values with the inclusion of, with increase in time of storage and with variation in packaging materials. However, increasing OF substitution level did not exhibit much influence on values of both acid and peroxide for oils from stored noodles. Average peroxide values for the 5, 10. 15 and 20 % OF, stored in the three packages tested ranged after one , three and five months of storage, respectively , between 1.35 to 1.36; 5.99 to 6.15 and 8.21 to 8.22 m.eqv. peroxide / 1000 gm oil in the MOPP group , respectively ; between 2.25 to 2.28; 6.11 to 6.30 and 9.00 to 9.11 m.eqv. peroxide / 1000 gm. oil m oil in the PPO group, respectively ; 2.40 to 2.45; 7.00 to 7.50 and 11.15 to 11.18 m.eqv. peroxide / 1000 gm. oil in the PE group, respectively , compared to the 72 % WF stored control noodles (1.34, 5.36 and 8.11 in the MOPP group ;2.23, 5.99 and 8.99 in the PPO group; and 2.80, 7.11 and 11.19 in the PE group m. eqv. peroxide / 1000 gm. oil, respectively).

B. Dry powdered orange albedo (ALBEDO) :

Acid value of instant fried noodles prepared from WF substituted by different levels of ALBEDO (5, 10. and 15%) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from 0.56 mg KOH / 1gm oil before storage (zero time)to higher values. Average acid values for the 5, 10. and 15 ALBEDO after one , three and five months of storage, respectively, in the three packages tested ranged between 0.81 to 0.81 ,1.05 to 1.06 and 2.24 to 2.25 mg KOH / 1gm oil ,

respectively in the MOPP group, 0.90 to 0.89,1.04 to1.03 and 2.35 to 2.36 mg KOH / 1gm oil in the PPO group, respectively;0.92 to 0.91, 1.07 to 1.07 and 2.40 to 2.39 mg KOH / 1gm oil in the PE group, respectively , compared to the 72 % WF stored control noodles (0.80 , 1.04 and 2.21 ; 0.89, 1.03, and 2.32 , 0.90, 1.05 and 2.37 mg KOH / 1gm oil , respectively).

Peroxide value for oils of instant fried noodles prepared from WF by different levels of ALBED (5, 10 and 15) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from o.57 m m.eqv. peroxide /1000 gm oil before storage (zero time)to higher values. Average peroxide values for the 5, 10 and 15 ALBED after one , three and five months of storage, respectively , in the three packages tested ranged between 1.30 to 1.30 , 5.50 to 5.80 and 8.00 to 8.40 m.eqv. peroxide / 1000 gm oil in the MOPP group , respectively ; 2.30 to 2.33, 6.40 to 6.52, and 9.01 to 9.17 m.eqv. peroxide / 1000 gm. oil m oil in the PPO group, respectively ; 2.90 to 2.97 , 7.11 to 7.70, and 11.00 to 11.15 m.eqv. peroxide / 1000 gm. oil in the PE group, respectively , compared to the 72 % WF stored control noodles (1.34, 5.36 and 8.11 ;2.23, 5.99 and 8.99 and 2.80, 7.11 and 11.19 m. eqv. peroxide / 1000 gm. oil, respectively).

C. Corn flour (CF) :

Acid value of instant fried noodles prepared from WF substituted by different levels of corn flour (10. 20 and 30 %) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from 0.53 mg KOH / 1gm oil before storage (zero time)to higher values. Average acid values for the 10,20 and 30 % Corn flour after one , three and five months of storage, respectively, in the three packages tested ranged between

0.78 to 0.77 ,1.00 to 1.22 and 2.08 to 2.16 mg KOH / 1gm oil , respectively in the MOPP group ;0.86 to , 0.85, 1.00 to 1.21 and 2.26 to 2.24 mg KOH / 1gm oil in the PPO group, respectively; 0.85 to 0.88, 1.00 to 1.03 and 2.30 to 2.35 mg KOH / 1gm oil in the PE group, respectively , compared to the 72 % WF stored control noodles (0.80 , 1.04 and 2.21 ; 0.89, 1.03, and 2.32 , 0.90, 1.05 and 2.37 mg KOH / 1gm oil , respectively).

Peroxide value for oils of instant fried noodles prepared from WF by different levels of (10, 20 and 30 %) Corn flour then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from o.54 m.eqv. peroxide /1000 gm oil before storage (zero time)to higher values. Average peroxide values for the 10, 20and 30% Corn flour after one , three and five months of storage, respectively , in the three packages tested ranged between 1.33 to 1.34, 5.15 to 5.5 and 8.15 to 8.31 m.eqv. peroxide /1000 gm oil in the MOPP group , respectively ;2.40 to 2.042, 6.14 to 6.20 and 9.00 to 9.11 m. eqv. peroxide / 1000 gm. oil m oil in the PPO group, respectively ;2.80 to 2.83, 7.050 to 7.80 and 11.03 to 11.11 m .eqv. peroxide / 1000 gm. oil in the PE group, respectively , compared to the 72 % WF stored control noodles (1.34, 5.36 and 8.11 ;2.23, 5.99 and 8.99 and 2.80, 7.11 and 11.19 m. eqv. peroxide / 1000 gm. oil, respectively).

D. Dry bordered beet roots (BR) :

Acid value of instant fried noodles prepared from WF substituted by different levels of beet roots (4, 6 and 8%) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from 0.56 mg KOH / 1gm oil before storage (zero time)to higher values. Average acid values for the (4, 6 and 8%) BR after one , three and five months of storage,

respectively, in the three packages tested ranged between 0.78to 0.79 , 1.00 to 1.01 and 2.00 to 2.11 mg KOH / 1gm oil , respectively in the MOPP group ;0.86 to 0.87, 1.15 to 1.21 and 2.26 to 2.28 mg KOH / 1gm oil in the PPO group, respectively; 0.88 to 0.89, 1.30 to 1.31 and 2.30 to 2.36 mg KOH / 1gm oil in the PE group, respectively , compared to the 72 % WF stored control noodles (0.80 , 1.04 and 2.21 ; 0.89, 1.03, and 2.32 , 0.90, 1.05 and 2.37 mg KOH / 1gm oil , respectively).

Peroxide value for oils of instant fried noodles prepared from WF by different levels of beet roots (4, 6 and 8%) then packaged in MOPP, PPO, and PE films and stored at room temperature months increased from o.55 m.eqv. peroxide /1000 gm oil before storage (zero time)to higher values. Average peroxide values for the (4, 6 and 8%) BR after one , three and five months of storage, respectively , in the three packages tested ranged between 1.12 to1.35, 5.05 to 5.18, and 8.10 to 8.21 m.eqv. peroxide / 1000 gm oil in the MOPP group , respectively ; 2.30 to 2.35, 6.00 to 6.31 and 9.20 to 9.39 m.eqv. peroxide / 1000 gm. oil m oil in the PPO group, respectively ;2.70 to 2.87, 7.30 to 7.40 m.eqv. peroxide / 1000 gm. oil in the PE group, respectively , compared to the 72 % WF stored control noodles (1.34, 5.36 and 8.11 ; 2.23, 5.99 and 8.99 and 2.80, 7.11 and 11.19 m. eqv. peroxide / 1000 gm. oil, respectively).

Regardless of variation in type of packaging materials and kind of substituted material in stored instant noodles, there was a gradual increase in acid and peroxide values with the increase in storage time of noodles from one to five months. It was noticed that, among all kinds of natural substitutes tested, only in the stored okara group noodles, the effect of substitution level was remarkably clear. This

observation could be attributed ,probably, to the high crude fats content observed in the chemical composition of okara group noodles.

4.9.3. Effect of type of packages on oil stability parameters of experimental stored instant noodles as influenced by kind and level of natural substitutes:

Results presented in tables (30 and 31) and figs (from 17 to 24) indicated that both the acid and peroxide values for oils of instant fried noodles prepared from wheat flour of 72% ext. and packaged in metalized oriented polypropylene (MOPP), polypropylene oriented (PPO), and polyethylene (PE) films were greatly influenced by the variation in type of package upon their storage for periods up to five months at room temperature , regardless of the variation in kind and substitution level of natural substitutes tested.

For example, acid and peroxide values were the lowest in experimental noodles packaged with metalized oriented polypropylene (MOPP) and stored at room temperature for five months. Although these two values increased proportionally with the increase in time of storage up to five months, the magnitude of such increase was much lower than those recorded in their corresponding stored noodles packaged with polypropylene oriented (PPO) and polyethylene (PE) films.

In contrast, acid and peroxide values were the highest in experimental noodles packaged with polyethylene (PE) films and stored at room temperature for five months.. Although these two values increased further with the increase in time of storage up to five months, the magnitude of such increase was also higher than those recorded in their corresponding stored noodles packaged with polypropylene oriented (PPO) and polyethylene (PE) films.

For example, acid values for 72 %ext. WF instant fried noodles were increased from 0.55 before storage (at zero time) and packaging in metaliz oriented polypropylene (MOPP), polypropylene oriented (PPO), and polyethylene (PE) films, respectively, were increased to 0.80, 0.89 and 0.90 mg KOH / 1gm oil, respectively ,after one month; 1.04, 1.06, and 1.09 mg KOH / 1 gm oil, respectively , after three months :and 2.21, 2.32, and 2.37 mg KOH /1 gm oil, respectively, after five months of storage.

Peroxide values of instant fried noodles prepared from wheat flour of 72% ext. increased from 0.56 m.eqv. peroxide / 1000 gm before storage (at zero time) and packaging in metaliz oriented polypropylene (MOPP), polypropylene oriented (PPO), and polyethylene (PE) films, respectively , were increased to 1.34 , 2.23 and 2.80 m.eqv. peroxide / 1000 gm. oil , respectively, after one month ; 5.36 , 5.99 and 7.11 m.eqv. peroxide / 1000 gm. oil , respectively, after three months ; and 8.11. 8.99 and 11.19 m.eqv. peroxide / 1000 gm oil , respectively, after five months of storage

In close agreement to Similar findings were reported by **Cheigh and Kwon (1972)** and **Hynk and Nak (1972)** who found that A.V. of instant fried noodles increased slightly during the storage in color plastic packages, at room temperature, from 0.25 to 0.73 mg KOH /1 gm oil, while it reached to 2.11 mg KOH /1 gm oil, for samples stored in the same package , at room temperature, for 150 days.

The oil peroxide value of instant fried noodles packaged in PE film exceeded the border line of acceptability reported by **Person (1986)** (10 m. eqv of peroxide / 1000 gm of oil) after four months of storage at the two used temperature, while those packaged in PE and PPO films exceeded the same border line of

acceptability after five months of storage at the same temperatures. These results could also be contributed to the differences existed in the properties of packaging materials, such as high oxygen transmission which accelerate the lipid oxidation of instant fried noodles and hence, raised the peroxide value as observed with the stored experimental samples packaged with the PE film.

Similar findings were reported by **Hynk and Nak (1982)** who reported that peroxide value of fried instant noodles increased slightly during storage in plastic package at dark room. They mentioned that peroxide value reached to 25.4 m. eqv. Peroxide /1 kg oil after 150 days of samples stored at 35 $\pm$ 2C°.

The obtained results were also found to agree with those reported by **Abou-Zeid (2002)** who observed that the highest increasing rate in the peroxide value was found in potato chips packaged in metailzed oriented polypropylene (MOPP), and polypropylene oriented (PPO) films in comparison with those packaged in polyethylene (PE) film. The same author proved that the changes in peroxide value of stored samples at indoor conditions could be more related to oxygen transmission rate than light transmission of the packaging film.

4.9.4. Effect of kind and level of natural substitutes on organoleptic properties of stored instant noodles.

The organoleptic properties of fried instant noodles produced from wheat flours 72 % extraction as well as their corresponding noodles groups which were made from the same WF substituted by different levels of natural substitutes (5,10.15 % okara flour ; 5,10 and 15% dry powdered orange albedo; 10,20 and 30% corn flour ; and 4,6 and 8 % dry powdered beet roots) packaged in metalized

oriented polypropylene (MOPP) then stored, under room temperature, were performed after five months of packaging.

The samples were evaluated organoleptically by ten panelists for their appearance, color, flavor, tenderness, and stickiness where scores were given and their mean values were statistically analyzed using analysis of variance and least significant difference (LSD), as presented in table 32.

Results of the organoleptic sensory evaluation tests for fried instant noodles stored for five months room temperature indicated that there was great variation in the mean scores given for most of the sensory properties tested compared to the corresponding noodles tested organoleptically before packaging and storage (at zero time). However, the highest overall acceptability scores was attained by 72 % ext. WF control noodles followed by 5 and 10% albedo noodles ,then 5 and 10 % okara noodles , then 15% albedo noodles then 4% BR noodles then 15 % okara and 6% BR noodles. The lowest overall acceptability scores were registered for 8% BR noodles and the three (10 20 ,30 %) corn flour. Furthermore, there was no significant difference between 72 % ext. WF control noodles and the 5 % albedo noodles with respect to overall acceptability scores.

In general, there was no significant difference between stored 72 % ext. WF control noodles or 5 and 10 % okara noodles or 5 and 10 % albedo noodles in the mean scores given for appearance, color, tenderness and stickiness.

Table (32): Organoleptic evaluation of experimental noodles prepared from 72% WF substituted by different levels of various substitutes packaged in MOPP films and stored at room temperature for five months .

Treatment and substitution level	Scores for sensory evaluation						
	Sample No.	Appearance 20	Color 20	Tenderness 25	Flavor 20	Stickiness 15	Overall acceptability 100
Wheat flour of 82% extraction	1	16.13^{a}	16.26^{a}	21.34^{a}	13.84^{a}	14.41^{a}	81.99^{a}
Okara dry flour group							
90% WF + 10% OF	2	15.14^{abc}	15.93^{ab}	20.33^{bc}	11.79^{def}	14.10^{ab}	77.29^{bcd}
85% WF + 15% OF	3	15.14^{abc}	15.33^{abc}	19.67^{cde}	10.36^{gh}	13.86^{abcd}	75.84^{cd}
80% WF + 20% OF	4	13.50^{efgh}	14.79^{abcd}	21.01^{ab}	13.23^{ab}	13.86^{abcd}	72.17^{ef}
Dry powdered orange abledo							
95% WF + 5% ALBEDO	5	15.07^{abc}	15.79^{ab}	21.01^{ab}	13.23^{ab}	13.96^{abc}	79.06^{ab}
90% WF + 10% ALBEDO	6	15.29^{ab}	15.79^{ab}	21.07^{ab}	12.79^{bcd}	13.49^{dcde}	78.41^{bc}
85% WF + 15% ALBEDO	7	14.53^{bcde}	15.04^{abcd}	20.24^{bc}	11.93^{bef}	13.14^{defg}	74.89^{de}
Corn flour group							
90% WF + 10% CF	8	12.57^{gh}	13.64^{cdf}	18.33^{fgh}	10.50^{gh}	12.61^{fgh}	67.66^{g}
80% WF + 20% CF	9	12.29^{hi}	12.64^{ef}	18.00^{gh}	9.97^{h}	12.21^{hi}	65.11^{g}
70% WF + 30% CF	10	11.07^{i}	12.10^{f}	16.90^{i}	8.90^{i}	11.43^{i}	60.40^{h}
Dry powdered beet root group							
96% WF + 4% BR	11	13.99^{cdef}	14.07^{bcde}	19.20^{def}	12.16^{cde}	13.21^{cdefg}	72.63^{ef}
94% WF + 6% BR	12	13.64^{defg}	14.36^{abcde}	18.79^{efg}	11.64^{ef}	12.80^{efgh}	71.23^{df}
92% WF + 8% BR	13	12.86^{fgh}	13.29^{def}	17.57^{hi}	10.97^{fgh}	12.43^{gh}	67.11^{g}
LSD at 0.05	LSD	1.22	1.93	0.98	1.03	0.81	3.14

* Values of similar superscripts are significantly not different at probability < 0.5 %

It should be mentioned that ,some properties were influenced more than the others by storage conditions of the present study, especially , scores given for flavor of the substituted noodles. However, the only exception occurred with 5% albedo stored noodles which did not show any significant difference with scores given to the72 % ext. WF control noodles.

Results of the organoleptic sensory evaluation of stored fried instant noodles the superiority of okara and albedo as a substitute for wheat flour over beet root. The only property of stored BR noodles that was not significantly different from the 72 % ext. WF control noodles was color only at 6% level of substitution. The corn flour was found the worst substitute to WF compared to okara and albedo ,especially upon storage , under the conditions of the present investigation.