RESULTS & DISCUSSION

4. RESULTS AND DISCUSSION

4.1. Chemical composition of the used raw materials:

Hard wheat flour (HWF) 72% extraction rate, soft wheat flour (SWF) 72% extraction rate, defatted soybean flour (DSF) and soybean protein isolate (SPI) were analyzed for their chemical composition. The chemical composition included moisture, crude protein, ether extract, fiber, ash and total carbohydrates and the obtained results are shown in Table (1) and illustrated in Fig. (1).

Data in Table (1) show the chemical composition of raw materials. Moisture content was high in HWF and SWF (11.48% and 12.60%, respectively), while it was low in DSF (6.37%). It could be noticed that SPI contained the highest value in protein 89.02% (on dry weight basis). While it showed the lowest value in total carbohydrate 6.4%.

The same data indicated that DSF contained the highest value in

ether extract, fiber and ash were: 5.60, 4.59 and 7.49%, respectively.

Also, the results indicated that SWF contained the highest value of total carbohydrates 89.19%, followed by HWF 84.52%.

These results are in agreement with El-Badrawy (1994), Hafez (1996), Farvili *et al.* (1997), Abdel-Motaleb (2001) and Doweidar (2001).

Table (1): Chemical composition of raw materials.

Samples	Moisture %	On dry weight basis				
		Protein %	Ether extract %	Fiber %	Ash %	Total carbohydrates[@] %
Hard wheat flour (HWF) 72% extraction rate	11.48	14.12	0.66	0.30	0.40	84.82
Soft wheat flour (SWF) 72% extraction rate	12.60	9.34	0.61	0.35	0.51	89.54
Defatted soybean flour (DSF)	6.37	51.82	5.60	4.59	7.49	35.09
Soybean protein isolate (SPI)	8.50	89.02	0.76	1.46	2.36	7.86

[@]: by difference.

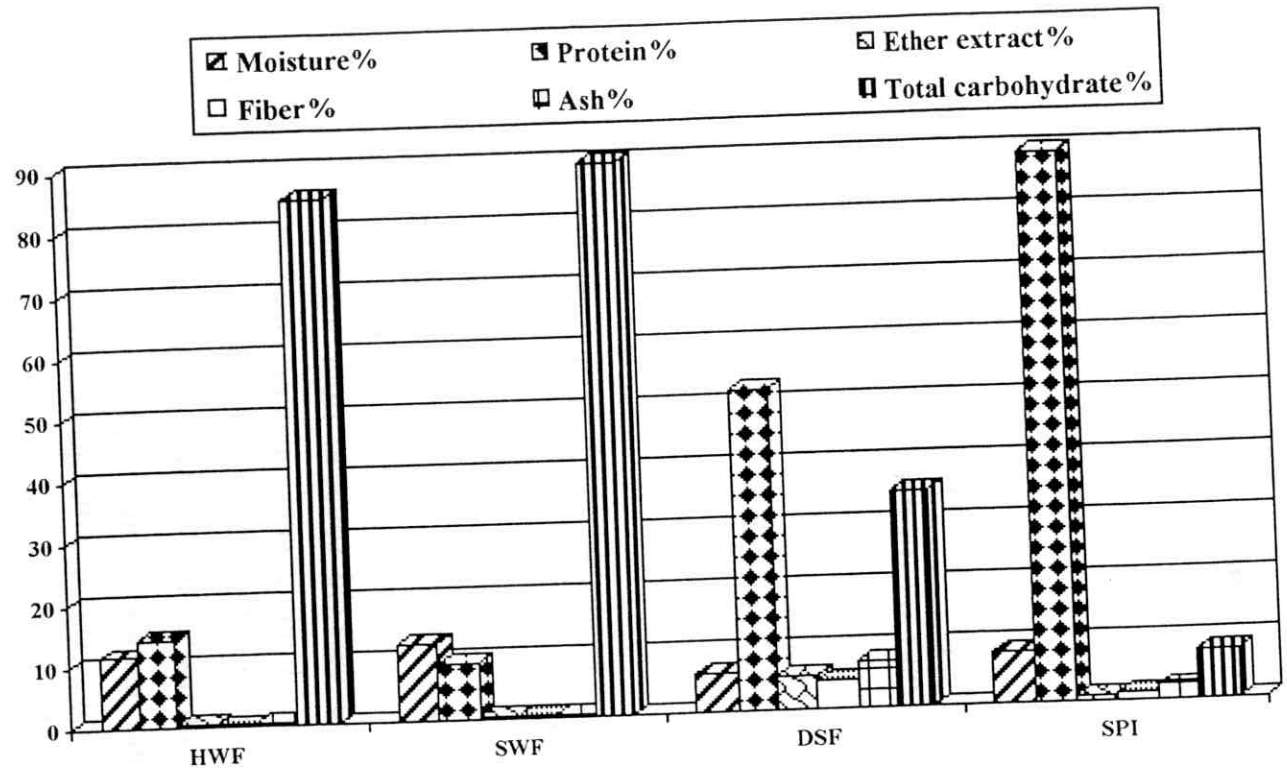


Fig. (1): Chemical composition of raw materials (hard wheat flour (HWF), soft wheat flour (SWF), defatted soybean flour (DSF) and soybean protein isolate (SPI).

4.2. Effect of substitution wheat flour 72% (hard or soft) with different levels of defatted soybean flour (DSF) and soybean protein isolate (SPI) on rheological properties of dough:

Rheological properties of wheat flour 72% extraction rate substituted with 10, 15 and 20% of defatted soybean flour and 2, 3 and 4% of soybean protein isolate (Tables, 2 and 3).

4.2.1. Farinogram parameters of wheat flour dough (HWF and SWF 72%) substituted with defatted soybean flour or soybean protein isolate at different levels:

Data in Tables (2 and 3) and illustrated in Figs (2 and 3) shows the effect of substitution of 10, 15 and 20% DSF and 2, 3 and 4 SPI for wheat flour 72% (hard or soft) on farinogram parameters.

From these results it could be noticed that the water absorption of dough increased gradually with increasing the added levels of DSF. While, addition of SPI decreased the water absorption. While, by increasing the levels of SPI the different of water absorption was not mosited. The increased water absorption of the defatted soybean flour may be due to the exposure of water binding sites on side chain of the protein previously blocked in a lipophilic environment. The hydrophilic properties of proteins are due to polar groups such as carbonyl, hydroxyl, amino carboxyl and sulphohydryl and the water binding capacity was varied with the number and type of polar group. Also, weakening of dough increased with increasing the

Table (2): Effect of substitution with different levels of defatted soybean flour and soybean protein isolate to hard wheat flour 72% extraction rate on Farinogram parameters.

Blends	Water absorption %	Development time (min.)	Stability time (min.)	Degree of weakening (BU)*
100% hard wheat flour 72% extraction rate (control)	71.5	5.0	6.0	30
90% hard wheat flour + 10% defatted soybean flour	76.0	5.5	2.0	70
85% hard wheat flour + 15% defatted soybean flour	76.5	6.0	2.0	80
80% hard wheat flour + 20% defatted soybean flour	82.1	4.0	1.5	85
98% hard wheat flour + 2% soybean protein isolate	70.8	5.0	3.0	40
97% hard wheat flour + 3% soybean protein isolate	70.5	6.0	5.0	40
96% hard wheat flour + 4% soybean protein isolate	70.5	7.0	3.0	40

* BU : Brabender units.

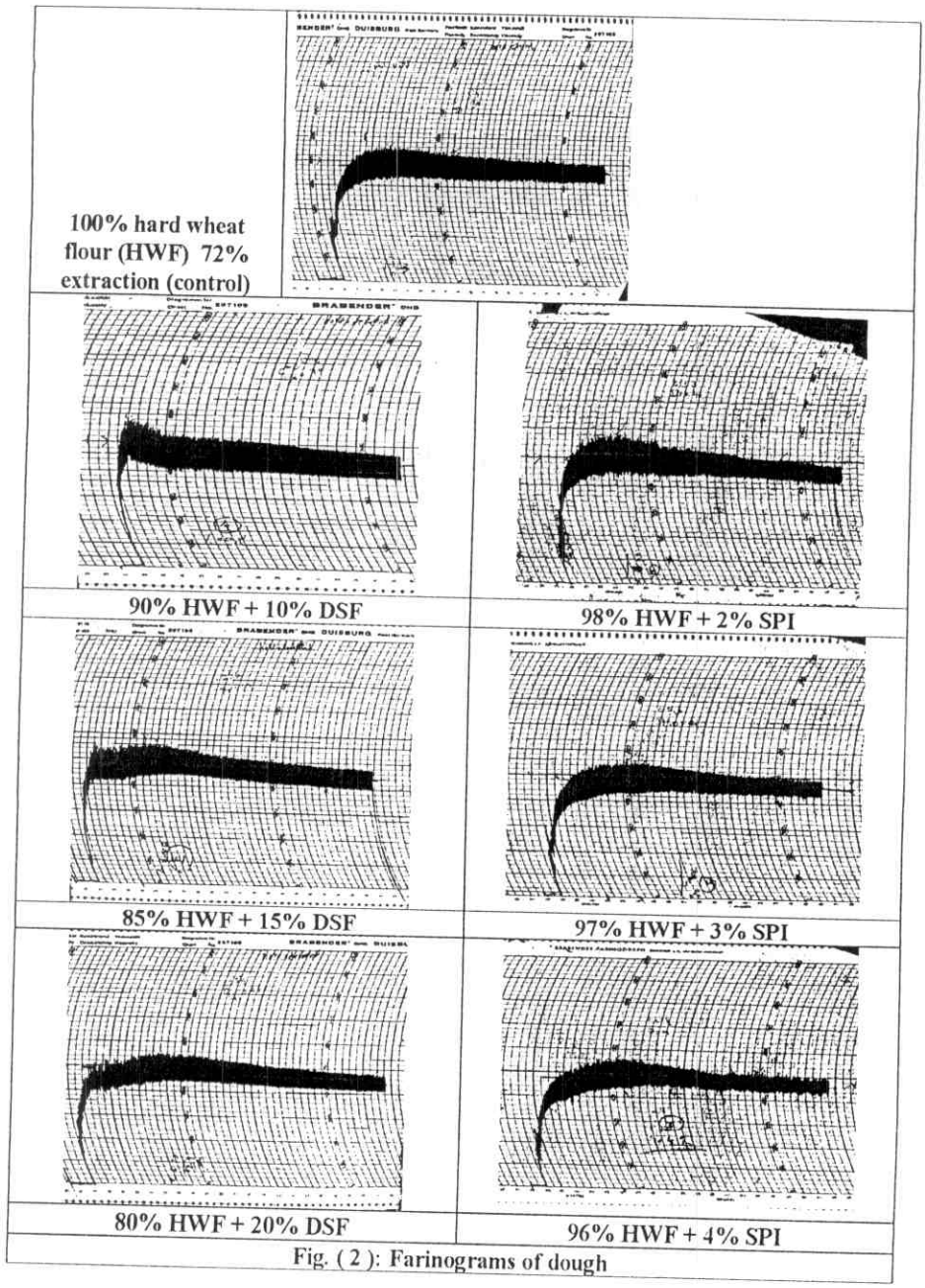


Fig. (2): Farinograms of dough

Table (3): **Effect of substitution with different levels of defatted soybean flour and soybean protein isolate to soft wheat flour 72% extraction rate on Farinogram parameters.**

Blends	Water absorption %	Development time (min.)	Stability time (min.)	Degree of weakening (BU)
100% soft wheat flour 72% extraction rate (control)	51.3	1.5	1.0	100
90% soft wheat flour + 10% defatted soybean flour	55.3	1.5	1.5	70
85% soft wheat flour + 15% defatted soybean flour	58.4	5.5	4.0	40
80% soft wheat flour + 20% defatted soybean flour	62.9	6.5	5.0	40
98% soft wheat flour + 2% soybean protein isolate	53.8	1.5	1.0	80
97% soft wheat flour + 3% soybean protein isolate	53.8	1.5	1.0	90
96% soft wheat flour + 4% soybean protein isolate	53.9	1.5	1.0	95

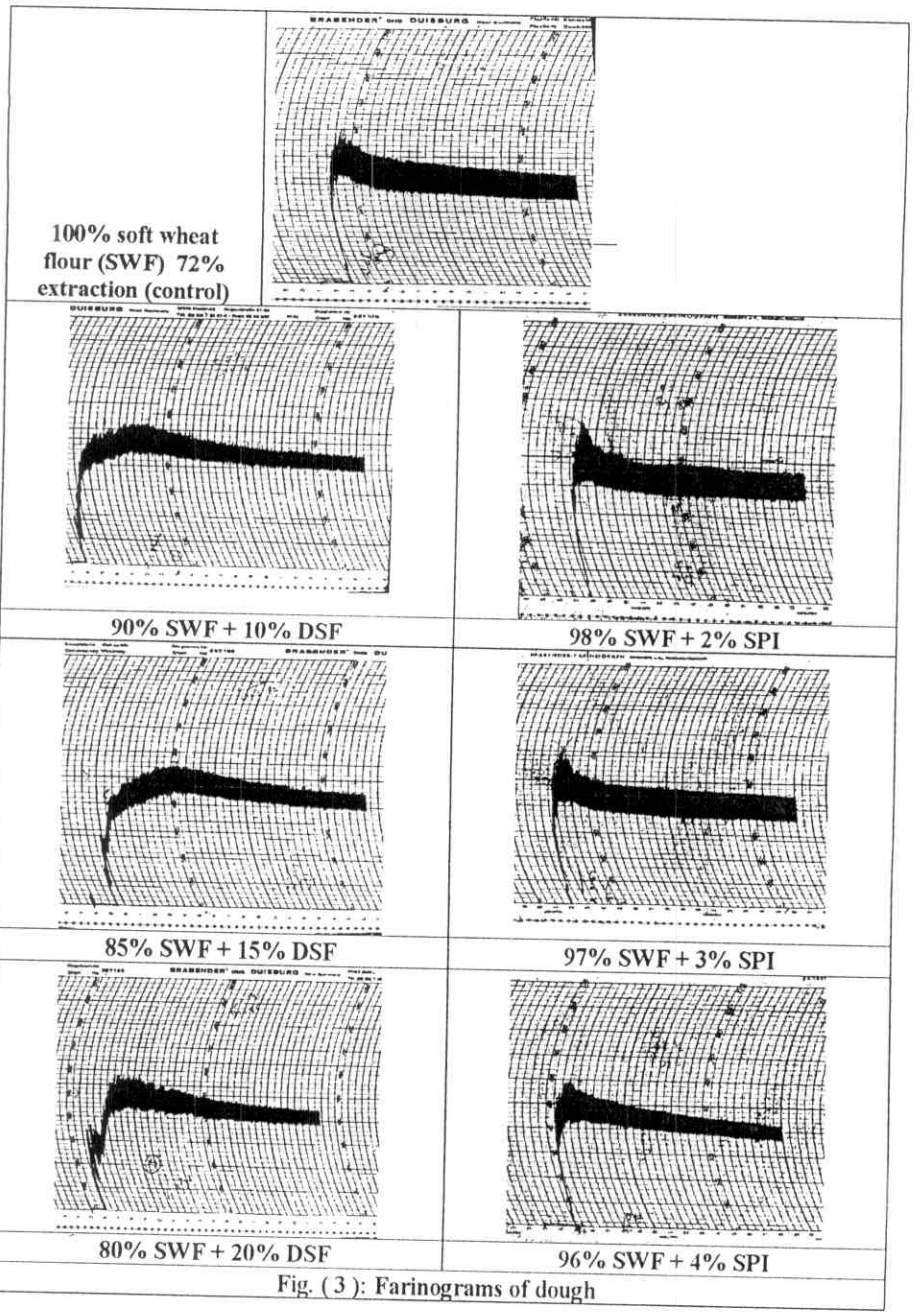


Fig. (3): Farinograms of dough

added levels of defatted soybean flour to hard wheat flour (Table, 2). While the weakening of dough decreased with increasing the added levels of defatted soybean flour to soft wheat flour (Table, 3).

But, the weakening was higher in dough prepared with blends of defatted soybean flour (DSF) with hard wheat flour (HWF) compared with control. Also, the weakening of dough produced from blends of SPI with HWF had no change with increasing the levels of SPI.

While, in case of soft wheat flour (SWF) it was found that the weakening was lower than that of control dough and the weakening increased with increasing the levels of added SPI.

Dough development time increased with increasing the added levels of DSF and SPI except 20% DSF. While, stability of dough was decreased with increasing the added levels of DSF and SPI compared with control.

These results are in agreement with Hafez (1996) and Abdel-Motaleb (2001).

4.2.2. Extensogram parameters of wheat flour dough (HWF and SWF 72%) substituted with defatted soybean flour or soybean protein isolate at different levels:

Results presented in Tables (4 and 5) and illustrated in Figs. (4 and 5) show the effect of replacement of defatted soybean flour and soybean protein isolate to wheat flour on Extensograph parameters. From these results, it could be observed that the extensibility (E) of dough supplemented with

Table (4): Effect of substitution with different levels of defatted soybean flour and soybean protein isolate to hard wheat flour 72% extraction rate on Extensogram parameters.

Blends	Resistance of extension R (BU)	Extensibility E (mm)	Proportional number (R/E)	Energy (cm^2)
100% hard wheat flour 72% extraction rate (control)	280	165	1.69	100
90% hard wheat flour + 10% defatted soybean flour	310	125	2.48	70
85% hard wheat flour + 15% defatted soybean flour	340	99	3.43	55
80% hard wheat flour + 20% defatted soybean flour	345	88	3.92	45
98% hard wheat flour + 2% soybean protein isolate	580	140	4.14	140
97% hard wheat flour + 3% soybean protein isolate	490	131	3.74	125
96% hard wheat flour + 4% soybean protein isolate	390	127	3.07	125

* BU : Brabender units.

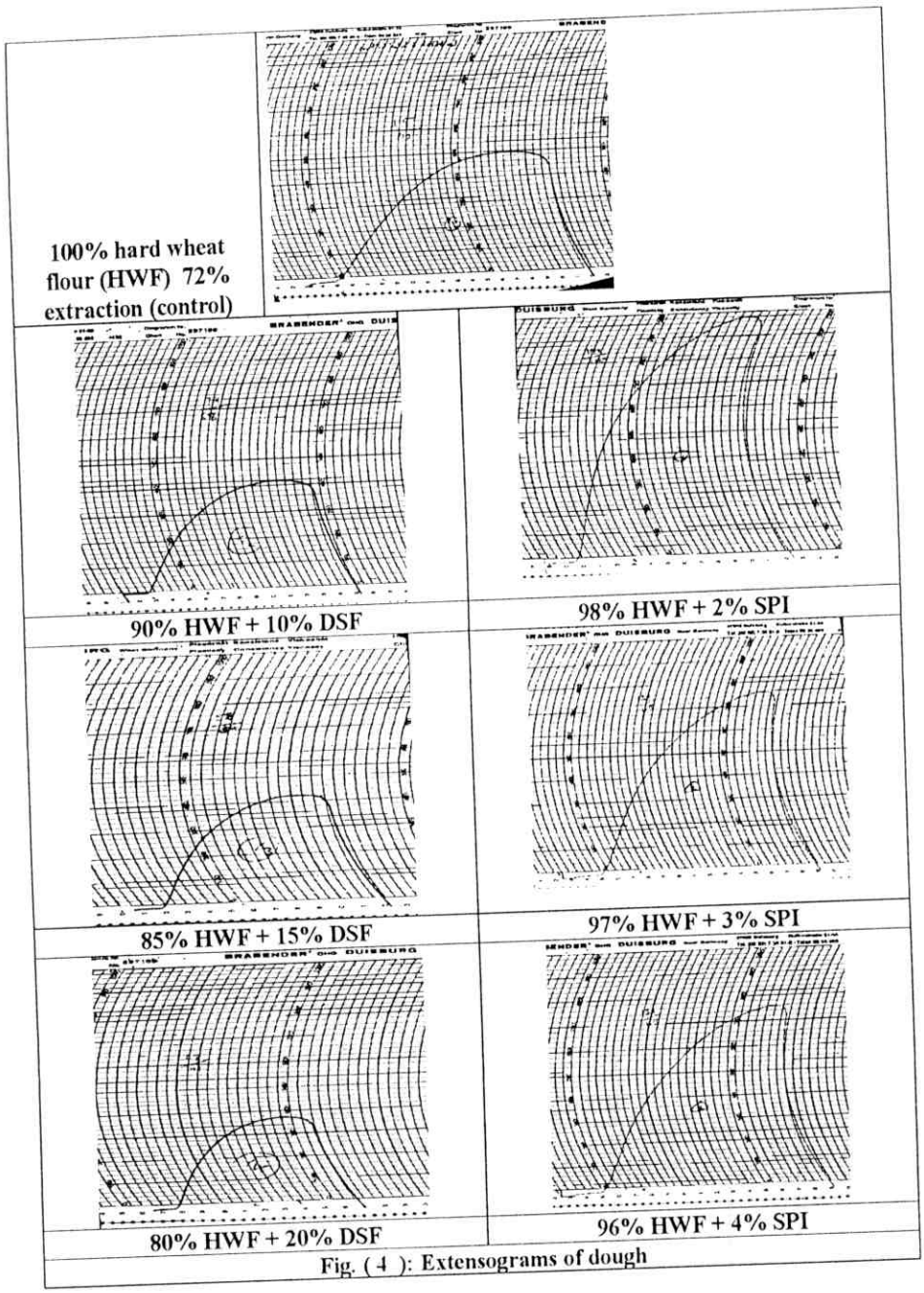


Fig. (4): Extensograms of dough

Table (5): Effect of substitution with different levels of defatted soybean flour and soybean protein isolate to soft wheat flour 72% extraction rate on Extensogram parameters.

Blends	Resistance of extension R (BU)	Extensibility E (mm)	Proportional number (R/E)	Energy (cm^2)
100% soft wheat flour 72% extraction rate	170	146	1.16	68
90% soft wheat flour + 10% defatted soybean flour	200	146	1.36	47
85% soft wheat flour + 15% defatted soybean flour	220	140	1.57	45
80% soft wheat flour + 20% defatted soybean flour	270	125	2.16	35
98% soft wheat flour + 2% soybean protein isolate	605	141	4.29	65
97% soft wheat flour + 3% soybean protein isolate	460	126	3.65	60
96% soft wheat flour + 4% soybean protein isolate	330	100	3.30	58

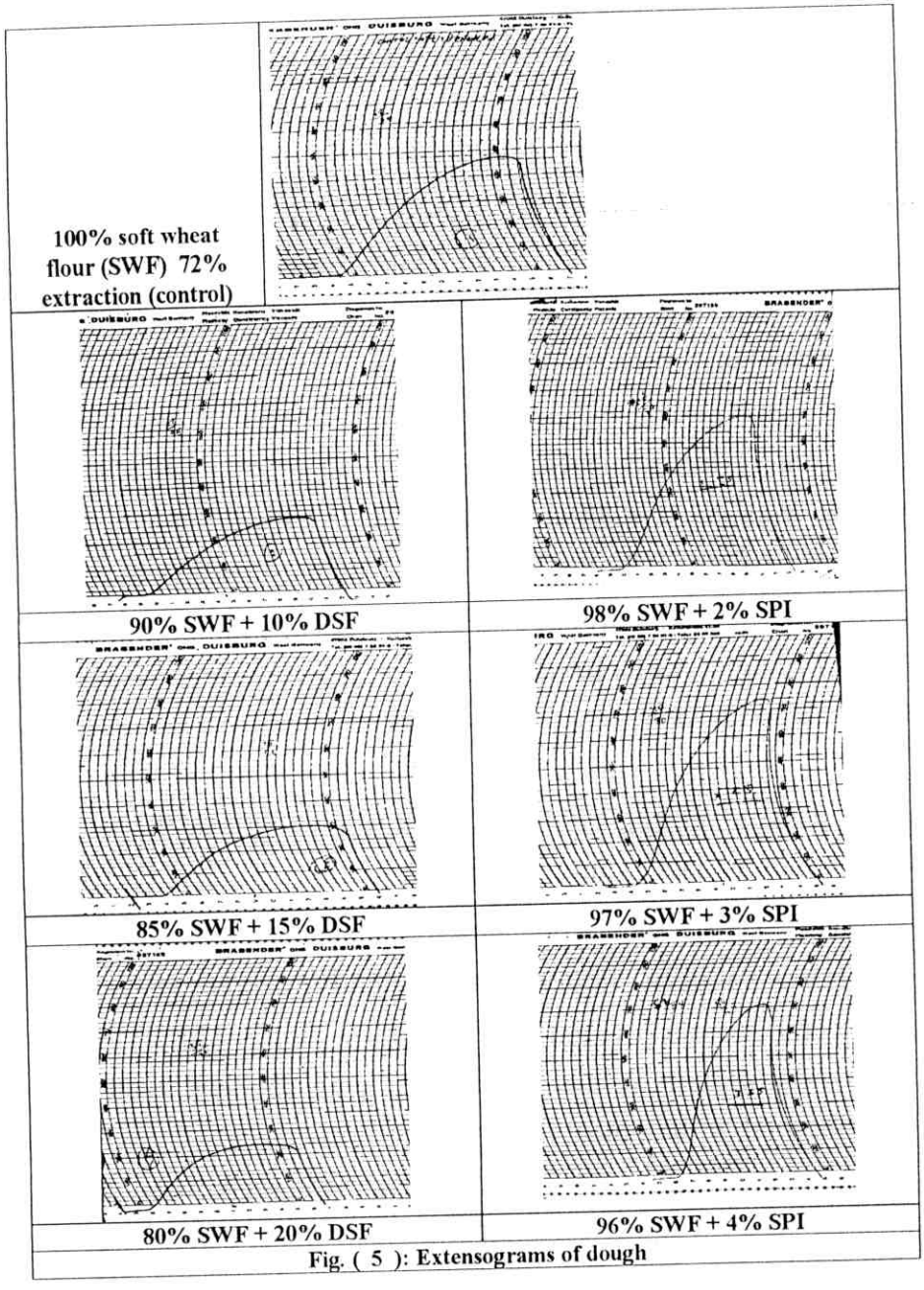


Fig. (5): Extensograms of dough

defatted soybean flour was clearly decreased with increasing the levels of defatted soybean flour. Also, extensibility of dough with soybean protein isolate decreased as the ratio of soybean protein isolate increased. These results are very close to the results reported by Hafez (1996) and Abdel-Motaleb (2001).

Concerning the resistance to extension (R) of dough, the ratio of 20% defatted soybean flour was higher (R). While resistance to extension increased with increasing the levels of defatted soybean flour. While replacement of soybean protein isolate to wheat flour was led to high resistance to extension compared to control (wheat flour 72% hard or soft). This may be due to the induction of more hydrogen bonds in gluten-carbohydrate complex of dough, which reinforces the dough resistance. These results agreed with those reported by (Hafez, 1996).

In the same time, the proportional number (R/E) of dough increased with increasing the levels of defatted soybean flour or soybean protein isolate (Tables, 4 and 5).

Energy values of dough prepared from hard wheat flour with defatted soybean flour were gradually decreased with increasing the levels of defatted soybean flour which that breakdown the gluten. While it increased with soybean protein isolate compared with control (Table, 4).

But, energy values in case of dough prepared from soft wheat flour with blends defatted soybean flour or soybean protein isolate were decreased with increasing levels of both. The results are in agreement with Abdel-Motaleb (2001).

4.3. Effect of substitution wheat flour 72% (hard or soft) with different levels of defatted soybean flour (DSF) and soybean protein isolate (SPI) on sensory characteristics of the following bakery products:

4.3.1. Pan bread:

The sensory characteristics, i.e., color of crust, texture of crumb, flavor, taste and general appearance of pan bread supplemented by different levels of DSF and SPI were evaluated by ten panelists and the obtained data were statistically analyzed as shown in Tables (6 and 7).

The data presented in Table (6) show that no significant difference between control and treatments 1 and 2 in color of crust, while treatment 3 had significant difference. Concerning texture of crumb there was no significant difference between control and all treatments.

On the other hand, significant difference was shown in Taste between control and treatment 1 and 2, also flavor of pan bread was shown significant difference between control and treatment 2 and 3. However, the results in the same Table revealed that pan bread produced from blend 1 had very good scores. While pan bread produced from blends 2 and 3 had good scores (Fig. 6).

It could be concluded that the substitution of 10% defatted soybean to produce pan bread could be recommended.

These results are in agreement with Hafez (1996) and Abdel-Motaleb (2001).

Table (6): Sensory evaluation of pan bread produced from hard wheat flour with different levels of defatted soybean flour (DSF).

Pan bread samples	Color of crust (20)	Texture of crumb (20)	Taste (20)	Flavor (20)	General appearance (20)	Overall scores (100)
Control*	18.40 a	17.80 a	18.80 a	19.00 a	18.80 a	92.80 a
1	18.00 ab	17.40 a	18.20 a	18.00 ab	18.80 a	90.00 ab
2	17.00 ab	17.40 a	17.00 b	17.20 b	18.40 a	87.00 bc
3	16.60 b	16.40 a	16.40 b	16.80 b	17.20 b	83.40 c
L.S.D. at 0.05	1.66	1.73	1.01	1.60	1.12	5.70

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

* Control: Pan bread prepared from 100% hard wheat flour 72% extraction rate.

1 : Pan bread prepared from 90% hard wheat flour + 10% defatted soybean flour.

2 : Pan bread prepared from 85% hard wheat flour + 15% defatted soybean flour.

3 : Pan bread prepared from 80% hard wheat flour + 20% defatted soybean flour.

Scores: 90-100 very good, 80-89 good, 70-79 satisfactory, less than 70 questionable.

The data in Table (7) shows significant difference between control pan bread and all treatments produced from the substitution of soybean protein isolate (2, 3 and 4%).

Concerning the texture of crumb, there were significant difference between control and treatment 4. Also, there were no significant difference between treatments 4 and 5 or 5 and 6, while it was significant difference between treatment 4 and treatment 6.

From the data in the same Table indicated that there were significant difference between control and all treatments in flavor. On the other hand, no significant difference between treatments 4, 5 and 6. While data had no significant difference between control and all treatments in taste.

In respect of general appearance pan bread showed significant difference between control pan bread and all treatments. While had no significant difference within treatments.

Also, Table (7) revealed that pan bread prepared from all treatments had good scores. From the results, it could be concluded that the substitution with different percentages of soybean protein isolate to wheat flour 72% extraction could be recommended until the levels reached 2% SPI.

The overall acceptability of all treatments prepared with DSF or SPI was lower than control (Fig. 6).

These results are in agreement with Song-Hwan and Chul (1999) and Abdel-Motaleb (2001). They found that the substitution

Table (7): Sensory evaluation of pan bread produced from hard wheat flour with different levels of soybean protein isolate (SPI).

Pan bread samples	Color of crust (20)	Texture of crumb (20)	Taste (20)	Flavor (20)	General appearance (20)	Overall scors (100)
Control	19.25 a	19.25 a	18.88 a	19.13 a	19.38 a	95.88 a
4	17.13 b	18.00 b	18.38 a	18.00 ab	17.63 b	89.13 b
5	16.88 b	17.50 bc	18.13 a	17.50 b	17.50 b	87.50 bc
6	16.25 b	17.13 c	18.00 a	17.50 b	17.00 b	85.88 c
L.S.D. at 0.05	0.91	0.59	0.90	1.23	0.74	2.98

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

* Control: Pan bread prepared from 100% hard wheat flour 72% extraction rate.

4 : Pan bread prepared from 98% hard wheat flour + 2% soybean protein isolate.

5 : Pan bread prepared from 97% hard wheat flour + 3% soybean protein isolate.

6 : Pan bread prepared from 96% hard wheat flour + 4% soybean protein isolate.

Scores: 90-100 very good, 80-89 good, 70-79 satisfactory, less than 70 questionable.

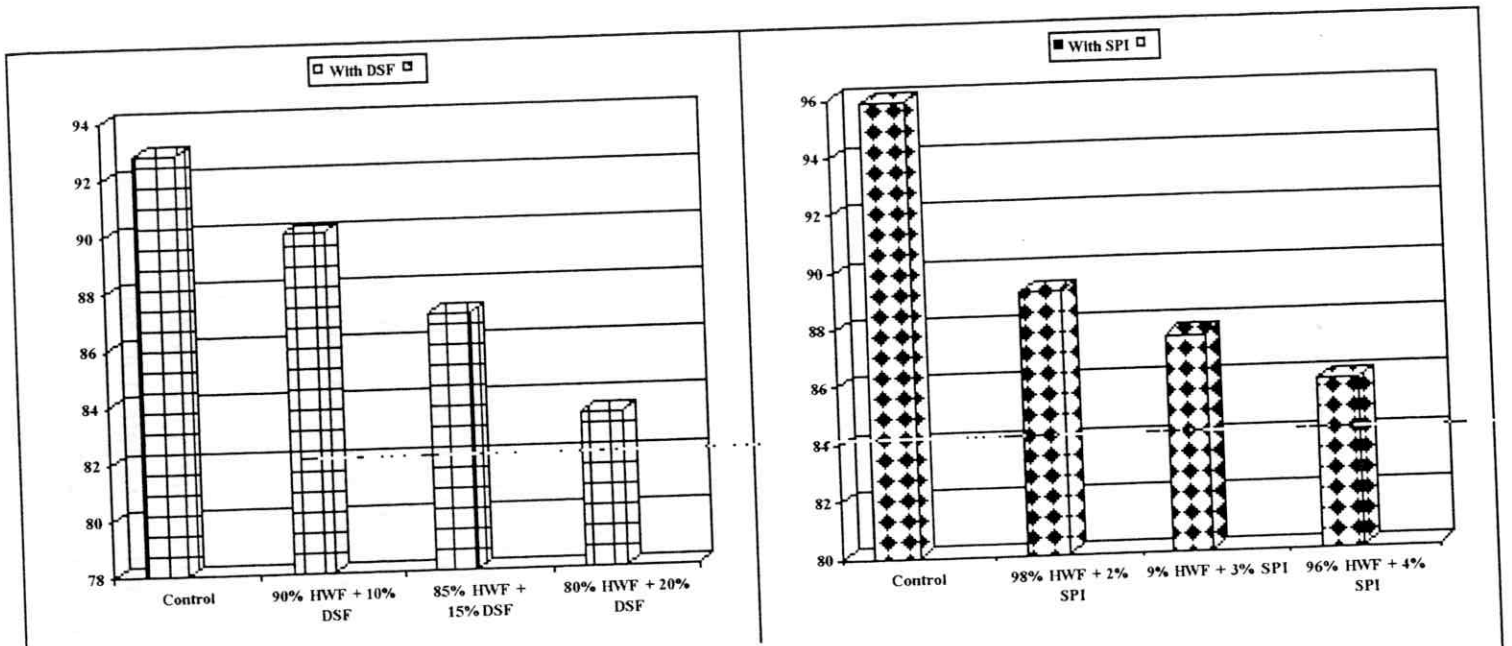


Fig. (6): Overall scores of pan bread produced from hard wheat flour with different levels of DSF or SPI.

with different percentage of soybean protein isolate to wheat flour to produce pan bread reached the level of 10%.

4.3.2. Cake:

The sensory characteristics, i.e. cells (uniformity, size of cells, thickness of walls) grain, texture (moistness, tenderness, softness), crumb color, taste and flavor of cup cakes prepared from wheat flour containing defatted soybean flour and soybean protein isolate with different levels were evaluated by ten panelists and the data obtained were statistically analyzed as shown in Tables (8 and 9) and illustrated in Fig. (7).

From the results presented in Table (8) and Fig. (7) it could be noticed that supplemented with 10% defatted soybean to wheat flour 72% extraction rate led to produce cake "very good" for all the evaluated characteristics compared with control while increase the supplementation percentage of defatted soybean flour showed significant decrease in all sensory characteristics of cake compared with control. These results are confirmed by Abo-Zeid (1998) who found that the addition of muffins (cakes) with 10, 20 and 30% defatted soybean flour increased crust color and the texture of cakes.

From the results presented in Table (9) and Fig. (7) it could be noticed that the supplementation of soybean protein isolate to wheat flour 72% extraction rate until level 2% produced cakes very good.

Concerning the statistical analysis indicated that insignificant difference was observed between control sample and 4% soybean protein isolate for cells, grain texture, crumb color, flavor and overall scores. These results are confirmed by

Table (8): Sensory evaluation of cake produced from soft wheat flour supplementing with different levels of defatted soybean flour.

Treatment	Cells			Grain	Texture			Crumb color	Flavor	Overall acceptability
	Uniformity (10)	Size of cells (10)	Thickness of walls (10)	(16)	Moistness (10)	Tenderness (14)	Softness (10)	(10)	(10)	(100)
Control	9.43 a	9.50 a	9.43 a	15.43 a	9.64 a	13.43 a	9.64 a	9.86 a	9.71 a	96.07 a
1	9.29 a	9.29 ab	9.43 a	15.43 a	9.61 a	13.29 a	9.64 a	9.64 ab	9.57 a	95.24 a
2	8.93 ab	8.50 bc	8.86 ab	14.57 b	9.14 ab	12.36 b	9.46 a	8.86 bc	9.36 ab	89.97 b
3	8.50 b	8.14 c	8.57 b	14.43 b	8.79 b	11.93 b	9.07 a	8.36 c	8.64 b	86.29 b
L.S.D. at 0.05	0.55	0.79	0.68	0.76	0.58	0.83	0.83	0.88	0.75	5.17

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

* Control: Cakes prepared from 100% soft wheat flour 72% extraction rate.

1 : Cakes prepared from 90% soft wheat flour + 10% defatted soybean flour.

2 : Cakes prepared from 85% soft wheat flour + 15% defatted soybean flour.

3 : Cakes prepared from 80% soft wheat flour + 20% defatted soybean flour.

Scores: 90-100 very good, 80-89 good, 70-79 satisfactory, less than 70 questionable.

Table (9): Sensory evaluation of cake produced from soft wheat flour supplementing with different levels of soybean protein isolate.

Treatment	Cells			Grain	Texture			Crumb color	Flavor	Overall acceptability
	Uniformity (10)	Size of cells (10)	Thickness of walls (10)	(16)	Moistness (10)	Tenderness (14)	Softness (10)	(10)	(10)	(100)
Control	10.00 a	10.00 a	9.80 a	15.40 a	9.60 a	13.40 a	10.00 a	10.00 a	10.00 a	98.20 a
4	9.60 a	9.20 ab	9.20 a	14.20 b	8.80 b	12.60 b	9.40 a	8.80 b	9.60 a	91.40 b
5	8.60 b	8.40 b	8.20 b	12.40 c	8.00 c	11.20 c	7.80 b	8.00 bc	8.40 b	81.00 b
6	7.80 c	7.00 c	6.60 c	11.80 c	7.00 d	10.40 d	7.40 b	7.20 c	7.60 b	72.80 c
L.S.D. at 0.05	0.52	0.86	0.62	0.78	0.65	0.70	1.08	0.90	0.92	2.95

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

* Control: Cakes prepared from 100% soft wheat flour 72% extraction rate.
4 : Cakes prepared from 98% soft wheat flour + 2% soybean protein isolate.
5 : Cakes prepared from 97% soft wheat flour + 3% soybean protein isolate.
6 : Cakes prepared from 96% soft wheat flour + 4% soybean protein isolate.

Scores: 90-100 very good, 80-89 good, 70-79 satisfactory, less than 70 questionable.

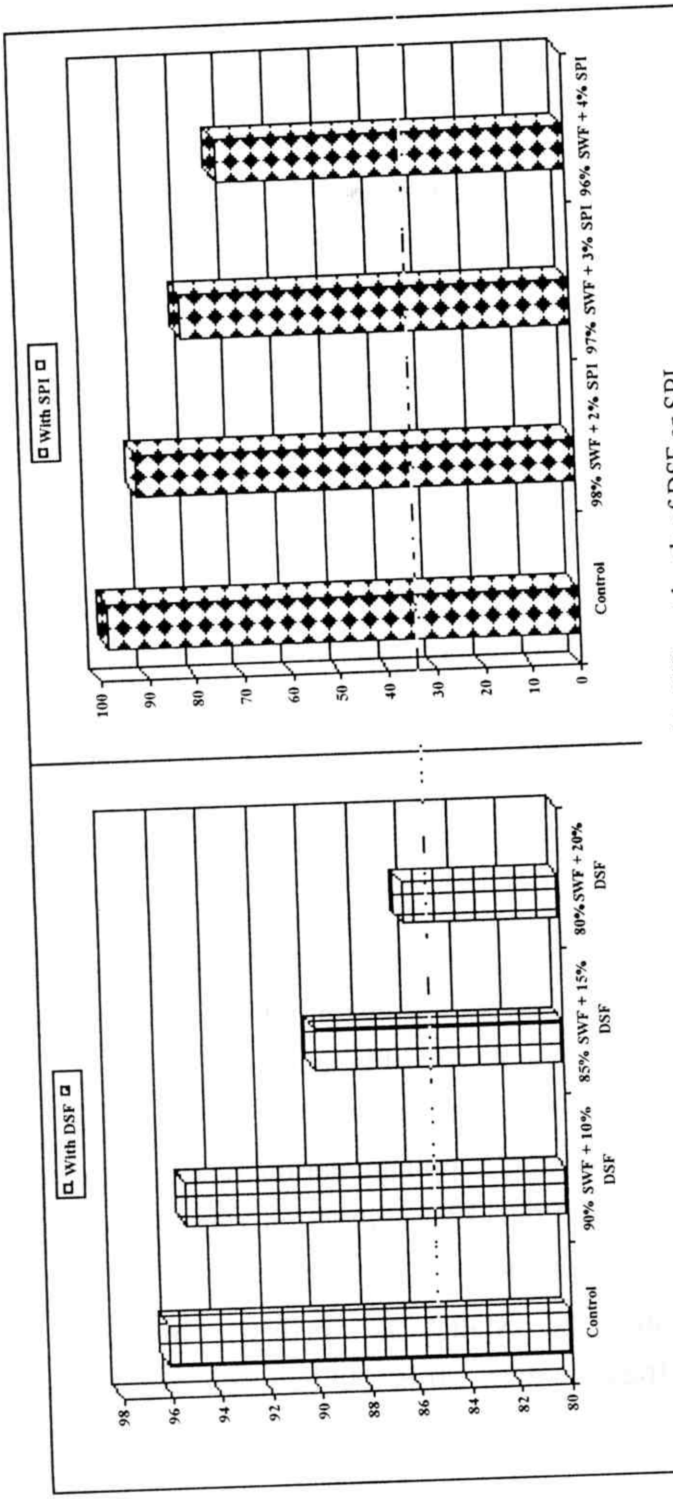


Fig. (7): Overall scores of cake produced from soft wheat flour with different levels of DSF or SPI.

Cameron *et al.* (1995) who reported that addition of soybean protein isolate up to 5% affect cake volume, peak height and interior cake tenderness.

4.3.3. Biscuits:

The sensory characteristics, i.e. color, texture, taste, flavor and appearance of biscuits prepared from wheat flour containing defatted soybean flour and soybean protein isolate with different levels were evaluated by ten panelists and the data obtained were statistically analyzed as shown in Tables (10 and 11) and illustrated Fig. (8).

From the results presented in Table (10) and Fig. (11) it could be noticed that supplemented with 10% defatted soybean flour to soft wheat flour 72% extraction rate produced biscuits very good for all the evaluated characteristics nearly as control. While defatted soybean flour up to 10% showed significant decrease in all sensory characteristics of biscuits. Also, biscuits supplemented with defatted soybean flour until 20% gave good biscuits.

These results are in agreement with Ranjana *et al.* (1996), who found that sweet biscuits preparation of defatted soybean flour up to 20% affect all quality of biscuits.

From the results presented in Table (11) and Fig. (8) it could be noticed that the supplementation of soybean protein isolate to soft wheat flour 72% extraction rate until level 3% produced biscuits very good for sensory evaluation.

Concerning the statistical analysis indicated that insignificant difference was observed between control sample

Table (10): Sensory evaluation of biscuits produced from soft wheat flour supplementing with different levels of defatted soybean flour.

Treatment	Color (20)	Texture (20)	Taste (20)	Flavor (20)	Appearance (20)	Overall acceptability (100)
Control	19.57 a	19.29 a	19.43 a	19.71 a	19.71 a	97.71 a
1	19.29 a	19.14 a	19.29 a	19.57 ab	19.57 a	96.85 a
2	18.57 b	17.00 b	17.57 b	18.57 bc	18.00 b	89.71 b
3	18.00 c	15.88 c	16.43 c	17.71 c	16.71 c	84.71 c
L.S.D. at 0.05	0.52	0.66	0.74	1.07	0.65	1.88

a, b and c: There is no significant difference ($P<0.05$) between any two means, within the same column.
* Control: Biscuits prepared from 100% soft wheat flour 72% extraction rate.
1 : Biscuits prepared from 90% soft wheat flour + 10% defatted soybean flour.
2 : Biscuits prepared from 85% soft wheat flour + 15% defatted soybean flour.
3 : Biscuits prepared from 80% soft wheat flour + 20% defatted soybean flour.
Scores: 90-100 very good, 80-89 good, 70-79 satisfactory, less than 70 questionable.

Table (11): Sensory evaluation of biscuits produced from soft wheat flour supplementing with different levels of protein isolate .

Treatment	Color (20)	Texture (20)	Taste (20)	Flavor (20)	Appearance (20)	Overall acceptability (100)
Control	20.00 a	19.60 a	19.60 a	19.80 a	20.00 a	99.00 a
4	19.60 a	19.20 a	18.60 b	18.60 a	19.00 a	95.00 b
5	19.60 a	19.20 a	18.60 b	18.60 a	19.00 a	95.00 b
6	18.00 b	16.60 b	16.20 c	16.20 b	16.20 b	83.00 c
L.S.D. at 0.05	0.71	0.52	0.55	1.53	1.35	2.87

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

* Control: Biscuits prepared from 100% soft wheat flour 72% extraction rate.

4 : Biscuits prepared from 98% soft wheat flour + 2% soybean protein isolate.

5 : Biscuits prepared from 97% soft wheat flour + 3% soybean protein isolate.

6 : Biscuits prepared from 96% soft wheat flour + 4% soybean protein isolate.

Scores: 90-100 very good, 80-89 good, 70-79 satisfactory, less than 70 questionable.

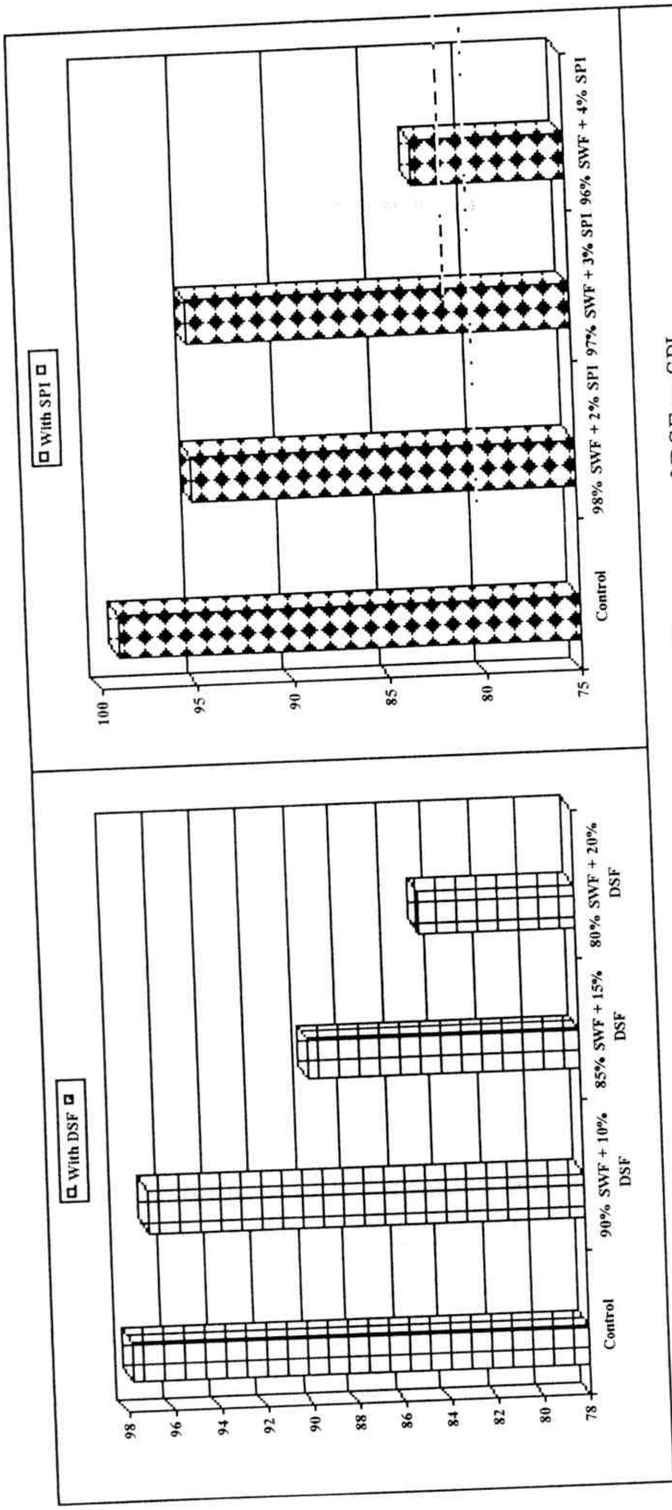


Fig. (8): Overall scores of biscuits produced from soft wheat flour with different levels of DSF or SPI.

and 4% soybean protein isolate for color of crust, texture, taste, flavor, appearance and overall scores. These results are confirmed by Hammad (2000).

4.4. Effect of substitution wheat flour 72% (hard or soft) with different levels of defatted soybean flour (DSF) and soybean protein isolate (SPI) on chemical composition:

4.4.1. Pan bread:

The changes of chemical composition in baked pan bread as influenced by different levels of defatted soybean and soybean protein isolate are presented in Table (12).

It could be noticed that, crude protein contents, ether extract, fiber and ash increased in the produced pan bread as increasing the different levels of DSF and SPI, while total carbohydrates was decreased.

These results are confirmed those results obtained by Magbool *et al.* (1987), Hammad (2000) and Abdel-Motaleb (2001).

4.4.2. Cakes:

The changes in the chemical composition of cakes were influenced by adding 10, 15, and 20% defatted soybean flour and 2, 3 and 4% soybean protein isolate and the results were obtained in Table (13).

Table (12): Chemical composition of pan bread produced from hard wheat flour 72% extraction rate substitution with defatted soybean flour and soybean protein isolate.

Components		Control	With defatted soybean flour			With soybean protein isolate		
			10%	15%	20%	2%	3%	4%
Moisture	%	5.65	6.37	6.78	10.39	6.36	6.56	6.99
Crude protein*	%	14.43	18.20	20.13	22.86	15.91	16.73	17.53
Ether extract*	%	2.40	3.12	3.56	4.09	2.58	2.79	3.08
Fiber*	%	0.32	0.68	0.93	1.17	0.32	0.33	0.33
Ash*	%	0.57	1.12	1.88	2.31	0.96	1.00	1.04
Total carbohydrates*@	%	82.60	77.56	74.43	70.74	80.55	79.49	78.38

* : On dry weight basis. @ : by difference.

Table (13): Chemical composition of cake produced from soft wheat flour 72% extraction rate substitution with defatted soybean flour and soybean protein isolate.

Components		Control	With defatted soybean flour			With soybean protein isolate		
			10%	15%	20%	2%	3%	4%
Moisture	%	5.22	3.00	3.01	3.38	4.67	4.54	4.82
Crude protein*	%	6.62	10.14	13.11	14.95	8.29	9.00	9.86
Ether extract*	%	8.61	10.45	11.08	11.93	9.01	9.33	9.54
Fiber*	%	0.45	1.29	1.81	2.79	0.53	0.55	0.57
Ash*	%	0.76	2.56	2.71	2.83	0.84	0.98	1.16
Total carbohydrates*@	%	83.99	76.85	73.10	70.29	81.86	80.69	79.44

* : On dry weight basis. @ : by difference.

From the results presented in Table (13), it could be noticed that the protein content ether extract, fiber and ash were increased with increasing the levels of DSF and SPI, while the total carbohydrates was decreased. These obtained results are inagreement agreed with that reported by Abo-Zeid (1998).

4.4.3. Biscuits:

The chemical composition of biscuits as influenced by different levels of defatted soybean flour and soybean protein isolate were studied and the obtained results are shown in Table (14).

It was found that the protein, ether extract, fiber and ash increased with increasing the different levels of defatted soybean flour and soybean protein isolate. While total carbohydrates decreased with increasing the added levels. This may be due to the high content of protein, ether extract, fiber and ash of control, El Shatanovi (1983), mentioned that supplemented biscuits with 10% soy flour increased protein and minerals content. Also, Hammad (2000) found that biscuits supplemented with all percentages (5 to 20%) of defatted soy flour or soy protein isolate had high percentages of protein and ash.

Table (14): Chemical composition of biscuits produced from soft wheat flour 72% extraction rate substitution with defatted soybean flour and soybean protein isolate.

Components		Control	With defatted soybean flour			With soybean protein isolate		
			10%	15%	20%	2%	3%	4%
Moisture	%	5.50	4.78	5.45	5.80	4.45	4.20	4.35
Crude protein*	%	8.11	12.21	14.45	16.53	9.64	10.50	11.25
Ether extract*	%	12.06	12.76	13.10	13.27	12.17	12.23	12.48
Fiber*	%	0.52	0.93	1.24	1.36	0.57	0.61	0.67
Ash*	%	1.06	1.72	2.00	2.46	1.67	1.74	1.80
Total carbohydrates*@	%	78.77	73.31	70.45	67.74	71.52	75.53	74.47

* : On dry weight basis. @ : by difference.

4.5. Effect of substitution wheat flour 72% (hard or soft) with different levels of defatted soybean flour (DSF) and soybean protein isolate (SPI) on physical properties:

4.5.1. Pan bread:

Table (15) shows that the weight of control pan bread was low, while the volume and specific volume were high compared with all treatments. Weight of pan bread was increased with increasing the levels of DSF and SPI. This may be due to dilution of protein gluten and consequently reduce the loaf volume.

These results are in agreement with that reported by Song-Hwan and Chul (1999).

4.5.2. Cakes:

Physical properties of cakes prepared from soft wheat flour 72% extraction rate with different levels of defatted soybean and soybean protein isolate are studied and the obtained results und in Table (16).

It could be observed that cake weight was increased gradually with increasing the levels of defatted soybean and soybean protein isolate while volume was decreased gradually with increasing the levels of defatted soybean and soybean protein isolate. Also, specific volume was decreased with increasing the levels of defatted soybean and soybean protein isolate.

Table (15): Effect of substituted different levels of defatted soybean flour and soybean protein isolate to hard wheat flour 72% extraction rate on physical properties of the produced pan bread.

Samples of pan bread		Weight (g)	Volume cm^2	Specific volume (cm^2/g)
Control (pan bread prepared from hard wheat flour 72% extraction rate)		102.63	430	4.19
Pan bread prepared from hard wheat flour 72% extraction rate with defatted soybean flour by	10%	112.10	421	3.80
	15%	114.38	348	3.04
	20%	116.33	338	2.90
Pan bread prepared from hard wheat flour 72% extraction rate with soybean protein isolate by	2%	106.54	425	3.98
	3%	108.12	420	3.88
	4%	113.87	395	3.46

Table (16): **Effect of substituted different levels of defatted soybean flour and soybean protein isolate to soft wheat flour 72% extraction rate on physical properties of the produced cake.**

Samples of cake		Weight (g)	Volume cm^2	Specific volume (cm^2/g)
Control (cake prepared from soft wheat flour 72% extraction rate)		186.20	440	2.36
Cake prepared from soft wheat flour 72% extraction rate with defatted soybean flour by	10%	193.40	390	2.01
	15%	203.24	365	1.79
	20%	220.63	305	1.38
Cake prepared from soft wheat flour 72% extraction rate with soybean protein isolate by	2%	190.58	385	2.02
	3%	195.55	380	1.94
	4%	198.55	375	1.88

These results are confirmed by those obtained by Abo-Zeid (1998).

4.6. Biological evaluation of tested pan bread, cake and biscuits contained defatted soy flour or soy protein isolate experimental diets:

Growing Albino rats were fed on various diets contained 10% protein. Several biological parameters as feed efficiency (FE), net protein utilization (NPU), digestibility coefficient (DC), and biological value (BV) were determined to evaluate the nutritional quality of protein.

4.6.1. Feed efficiency (FE):

Growing Albino rats fed on various diets for 10 days. The body weight gain and feed intake were measured. The FE was calculated and the data are tabulated in Table (17) and illustrated in Fig. (9).

From the results presented in Table (17), it could be noticed that the FE of casein was 0.17 Shekib *et al.* (1989) found that the FE casein was about 0.22.

The data in the same Table indicated that, the lowest value of FE was observed for pan bread produced from 1 and 2. The others experimental diets showed lower values than casein diet, except, cake treatment gave highest value of FE. On the other hand, the rats fed on pan bread, cake and biscuits supplemented with defatted soybean flour (DSF) and soybean protein isolate (SPI) had low value of FE, this may be due to

Table (17): **The effect of pan bread, cake and biscuits experimental diets on weight gain, feed intake and feed efficiency of feeding rats after 10 days (mean±SD).**

Treatment		Initial weight (g)	Final weight (g)	Gain in weight (g) [A]	Feed intake (g) [B]	Feed efficiency A/B
Casein		104.33[a] ±12.10	134.33[a] ±17.21	30.00[c] ±5.20	177.33[a] ±3.06	0.17[b] ±0.03
Pan bread	1	74.67[c] ±0.58	84.27[c] ±1.40	9.60[d] ±1.56	155.20[b] ±4.18	0.06[c] ±0.01
	2	80.67[bc] ±1.53	91.03[c] ±1.21	10.17[d] ±0.81	154.60[b] ±14.30	0.07[c] ±0.01
	3	76.33[c] ±2.08	88.47[c] ±0.67	12.13[d] ±2.67	148.23[bc] ±6.05	0.08[c] ±0.02
Cake	4	89.67[bc] ±0.58	143.00[a] ±9.85	53.33[a] ±9.29	187.50[a] ±11.25	0.28[a] ±0.03
	5	80.00[c] ±5.00	116.33[b] ±5.86	36.33[bc] ±3.79	178.57[a] ±5.16	0.20[b] ±0.02
	6	91.67[b] ±17.10	131.00[ab] ±23.26	39.33[b] ±8.39	181.73[a] ±17.68	0.21[b] ±0.03
Biscuits	7	106.67[a] ±5.51	140.07[a] ±5.18	33.40[bc] ±0.78	178.60[a] ±23.94	0.18[b] ±0.03
	8	73.00[c] ±3.61	85.33[c] ±3.21	12.33[d] ±1.53	147.53[bc] ±9.70	0.08[c] ±0.01
	9	68.67[c] ±1.53	79.67[c] ±3.06	11.00[d] ±1.73	128.47[c] ±12.81	0.09[c] ±0.02
L.S.D.		11.50	16.16	7.41	20.02	0.04

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

1: Pan bread produced from 100% hard wheat flour (HWF) 72% extraction rate (control).
2: Pan bread produced from 90% HWF + 10% DSF.
3: Pan bread produced from 98% HWF + 2% SPI.
4: Cake produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
5: Cake produced from 90% SWF + 10% DSF.
6: Cake produced from 98% SWF + 2% SPI.
7: Biscuits produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
8: Biscuits produced from 90% SWF + 10% DSF.
9: Biscuits produced from 98% SWF + 2% SPI.

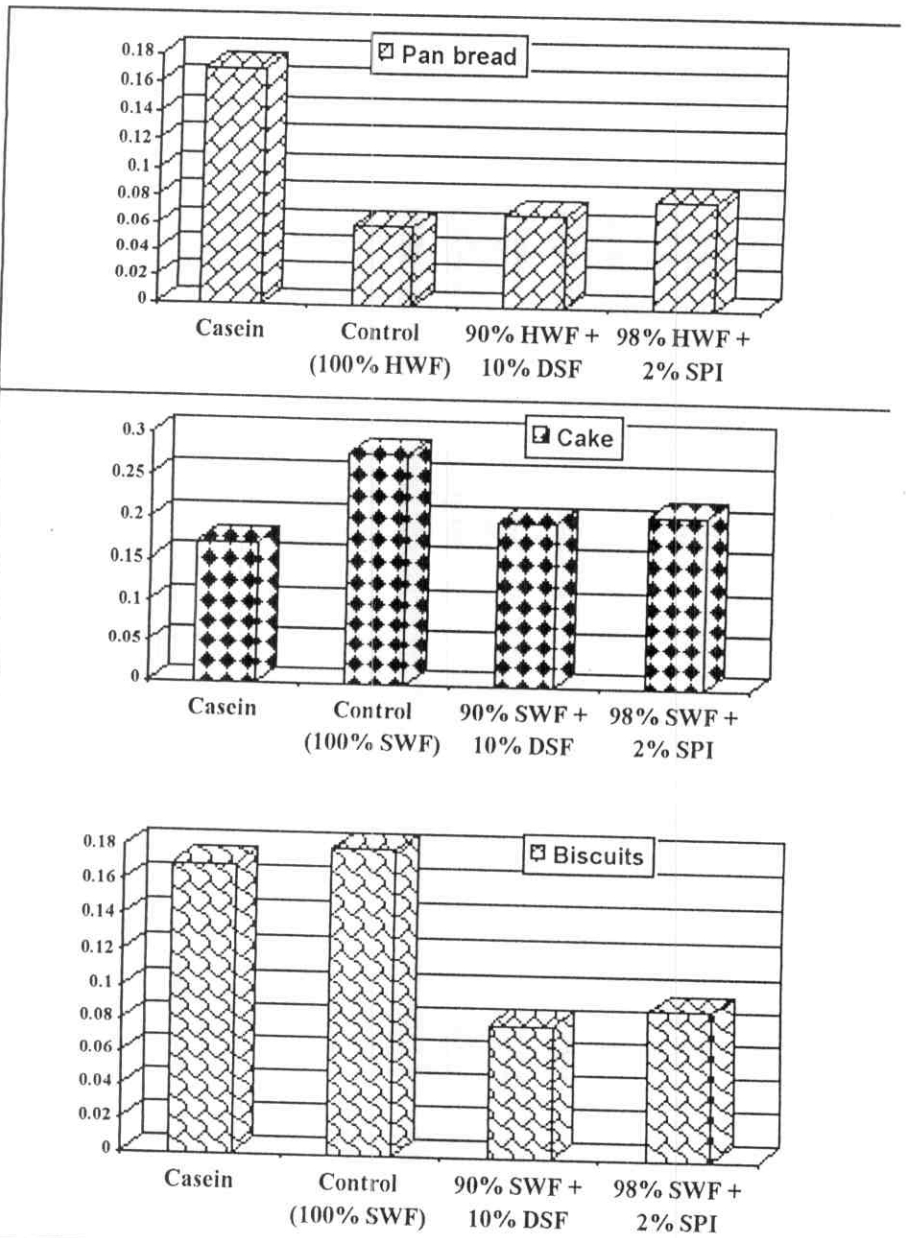


Fig. (9): Effect of diet by pan bread, cake and biscuits on feed efficiency (FE) after 10 days for rats.

antinutritional factors of soybean which inhibit the activity of enzymatic digestion of the food consumed.

Besides, there is no significant difference between pan bread samples ($P > 0.05$), while there were a significant differences between control and other treatments in samples of cake and biscuits.

Inclusion, the feed efficiency was lower in all samples prepared with defatted soybean flour or soybean protein isolate compared with control of pan bread, cake and biscuits.

These results agreed with that reported by Hussein and Jouncey (1993). Who found that the phytic acid decreases the feed efficiency.

West *et al.* (1992) reported that tannin protein complexes considering as the important factor that inhibit the protein metabolism.

4.6.2. Net protein utilization (NPU):

The NPU of rats fed on different diets were shown in Table (18) and illustrated in Fig. (10).

The data in Table (18) indicated that the NPU of the casein diet was higher (89.49%) than other diets.

The same Table shows that there are no significant differences between casein diet and other experimental diets prepared except control of pan bread, cake and biscuits. While there are no significant differences between control and samples prepared with defatted soybean flour or soybean protein isolate in pan bread, cake and biscuits ($P > 0.05$).

Table (18): Nitrogen intake, body nitrogen and net protein utilization (NPU) of rats fed on pan bread, cake and biscuits experimental diets for 10 days (mean±SD).

Treatment		Nitrogen intake (g)	Body nitrogen (g)	Net protein utilization %	Key treatment
Casein		2.83^{a} ±0.05	3.79^{a} ±0.48	89.40^{a} ±15.55	1: Pan bread produced from 100% hard wheat flour (HWF) 72% extraction rate (control).
Pan bread	1	2.48^{b} ±0.06	3.02^{de} ±0.08	70.97^{bc} ±4.13	2: Pan bread produced from 90% HWF + 10% DSF.
	2	2.47^{b} ±0.23	3.18^{c} ±0.14	77.73^{abc} ±2.15	3: Pan bread produced from 98% HWF + 2% SPI.
	3	2.37^{bc} ±0.10	3.16^{c} ±0.08	80.17^{abc} ±1.06	4: Cake produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
Cake	4	2.85^{a} ±0.09	3.22^{c} ±0.18	68.77^{abc} ±20.49	5: Cake produced from 90% SWF + 10% DSF.
	5	2.90^{a} ±0.29	3.39^{bc} ±0.40	73.45^{abc} ±16.92	6: Cake produced from 98% SWF + 2% SPI.
	6	3.00^{a} ±0.18	3.59^{ab} ±0.51	77.67^{c} ±4.45	7: Biscuits produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
Biscuts	7	2.85^{a} ±0.38	3.26^{c} ±0.08	70.18^{bc} ±9.58	8: Biscuits produced from 90% SWF + 10% DSF.
	8	2.05^{c} ±0.20	2.87^{e} ±0.25	78.51^{abc} ±8.62	9: Biscuits produced from 98% SWF + 2% SPI.
	9	2.35^{bc} ±0.16	3.26^{c} ±0.14	85.11^{ab} ±0.76	
L.S.D.		0.32	0.23	17.22	

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

1.26 = Body nitrogen of the group fed free protein (g)

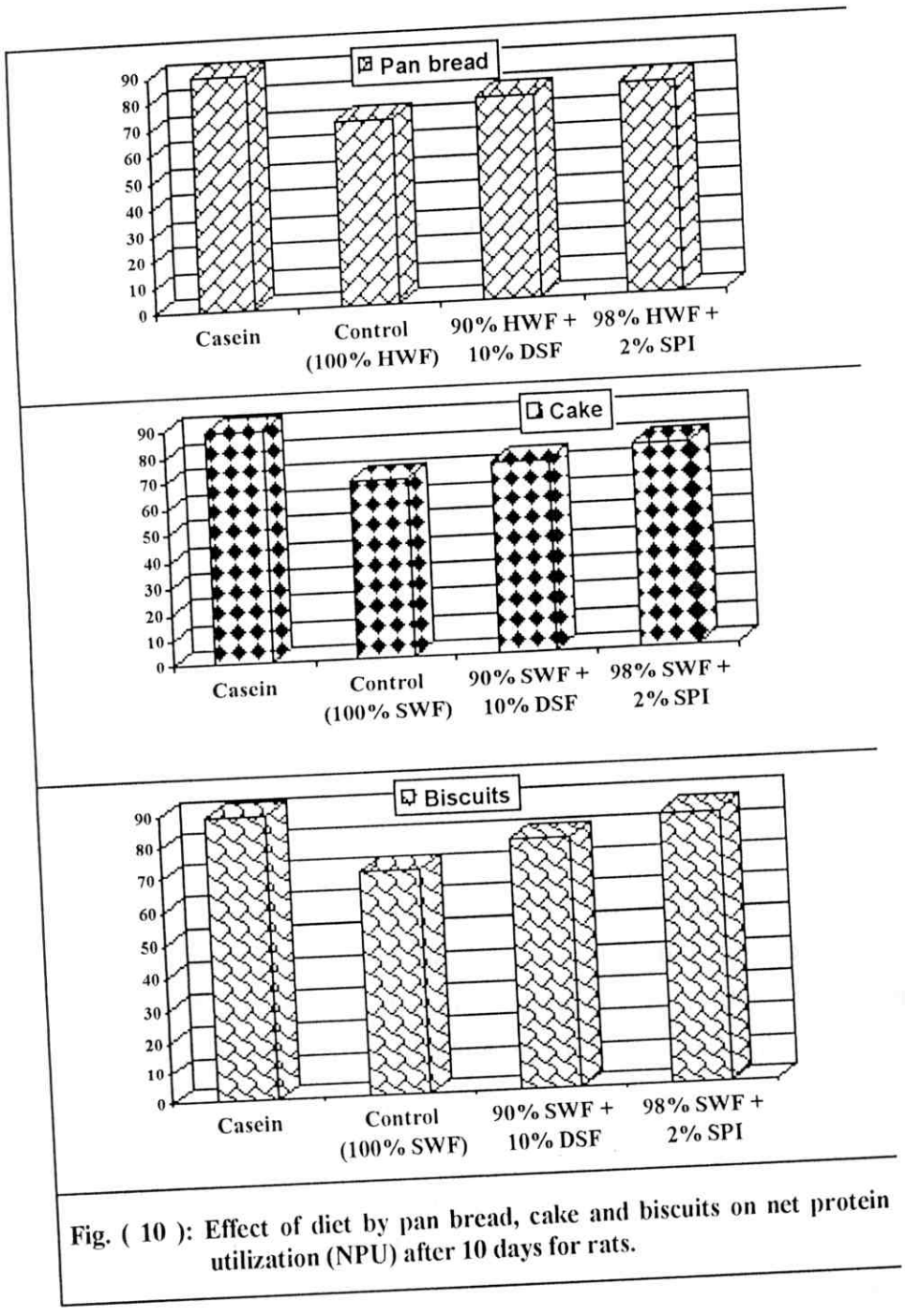


Fig. (10): Effect of diet by pan bread, cake and biscuits on net protein utilization (NPU) after 10 days for rats.

From the results in the same Table (18) it could be noticed that, the highest value of NPU (85.11%) was for biscuit 98% soft wheat flour + 2% soybean protein isolate. While diets prepared from biscuits 100% SWF had the lowest value (70.18%). The NPU value depends greatly on the scores of essential amino acids.

These results are inagreement with those obtained by Gonzalez and Serna (1988) and Soliman (1998) who noticed that net protein utilization (NPU) increased in muffin substituted with 10, 20 and 30% of defatted soybean.

4.6.3. Digestibility coefficient (DC):

Regarding to the results of DC of pan bread, cake and biscuits experimental diets in Table (19) and illustrated in Fig. (11) showed that, there were no significant difference between all the experimental diets and the control bread 100% what flour 72%, control cake and control biscuits.

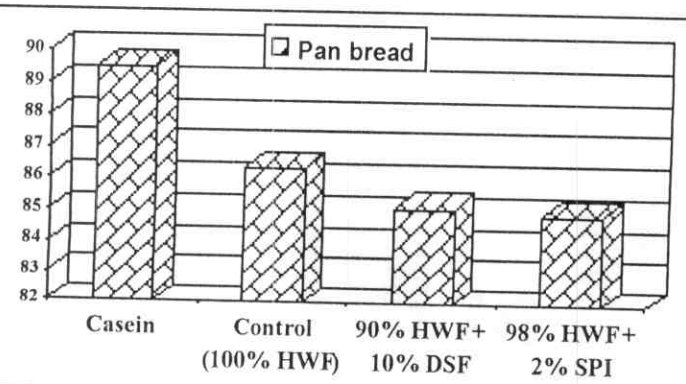
From the results it could be noticed that the fecal nitrogen during the control cake of experimental diets gave lowest value. While rats fed on control biscuits and control pan bread diets gave the highest value for fecal nitrogen 0.43 and 0.40, respectively.

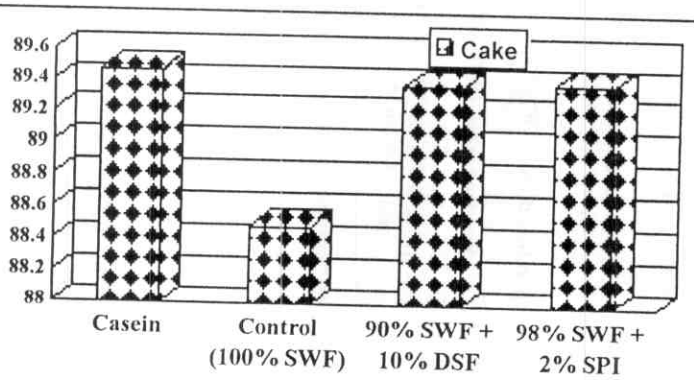
Also, the results from the same Table (19) show that, the DC of cakes biscuits with soybean protein isolate gave the highest value (89.49-88.17) followed by cakes with defatted soybean flour (89.38), biscuits with defatted soybean flour (84.98).

Table (19): Nitrogen intake, fecal nitrogen and digestibility coefficient (DC) of rats fed on pan bread, cake and biscuits experimental diets for 10 days (mean±SD).

Treatment		Nitrogen intake (g)	Fecal nitrogen (g)	Digestibility %	Key treatment
Casein		2.83^{a} ±0.05	0.36^{cd} ±0.03	89.47^{a} ±1.00	1: Pan bread produced from 100% hard wheat flour (HWF) 72% extraction rate (control).
Pan bread	1	2.48^{b} ±0.06	0.40^{abc} ±0.02	86.37^{bc} ±0.79	2: Pan bread produced from 90% HWF + 10% DSF.
	2	2.47^{b} ±0.23	0.43^{a} ±0.02	85.10^{c} ±3.81	3: Pan bread produced from 98% HWF + 2% SPI.
	3	2.37^{bc} ±0.10	0.42^{ab} ±0.03	84.89^{c} ±1.89	4: Cake produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
Cake	4	2.85^{a} ±0.09	0.39^{abcd} ±0.04	88.49^{ab} ±1.24	5: Cake produced from 90% SWF + 10% DSF.
	5	2.90^{a} ±0.29	0.37^{bcd} ±0.02	89.38^{a} ±2.06	6: Cake produced from 98% SWF + 2% SPI.
	6	3.00^{a} ±0.18	0.38^{abcd} ±0.03	89.40^{a} ±1.36	7: Biscuits produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
Biscuits	7	2.85^{a} ±0.38	0.43^{a} ±0.06	87.09^{c} ±1.79	8: Biscuits produced from 90% SWF + 10% DSF.
	8	2.05^{c} ±0.20	0.37^{bcd} ±0.02	84.98^{c} ±0.95	9: Biscuits produced from 98% SWF + 2% SPI.
	9	2.35^{bc} ±0.16	0.34^{d} ±0.03	88.17^{ab} ±0.99	
L.S.D.		0.32	0.06	2.88	

a, b, c and d: There is no significant difference ($P<0.05$) between any two means, within the same column.
0.062 = The fecal nitrogen value of the animal fed on the free protein diet.





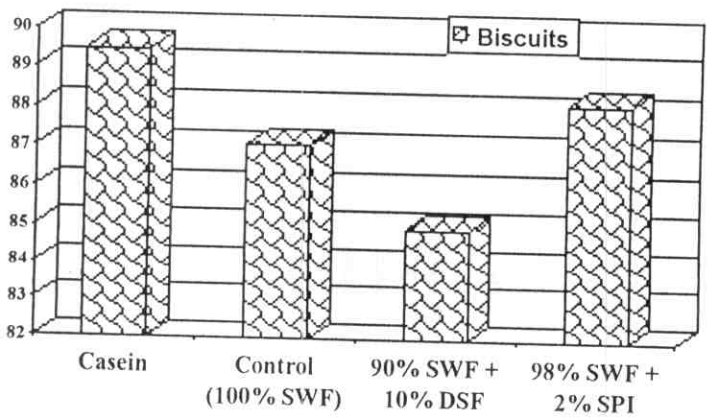


Fig. (11): Effect of diet by pan bread, cake and biscuits on digestability coefficient (DC) after 10 days for rats.

These obtained results are in the same line with those reported by El-Mahdy (1980) who mentioned that the digestibility coefficient (DC) of infant biscuits made from some cereal germs and legumes ranged from 88% to 95%.

Also, these results are in agreement with those reported by Abo-Zeid (1998) and Abdel-Motaleb (2001).

4.6.4. Biological value (BV):

The biological value (BV) was estimated by using the NPU and DC of rats fed on the experimental diets for 10 days. From the results presented in Table (20) and illustrated in Fig. (12) it could be noticed that the BV of casein was (99.92).

Also, the results in the same Table indicated that, the BV of biscuits prepared with SPI had the highest value (96.53) followed by pan bread prepared with SPI (94.43). There is a significant difference between treatment of pan bread (control), cake and biscuits and casein diet.

Data in Table (20) showed that the addition of defatted sybean flour or soybean protein isolate to wheat flour (hard or soft) related to increased in biological value compared to control of pan bread, cake and biscuits.

These results are in agreement with Faheid and Hegazi (1991) and Soliman (1998).

4.6.5. Protein efficiency ratio (PER):

Protein efficiency ratio (PER) explains the relationship between the rate of growth and the protein intake after 4 weeks.

Table (20): Nitrogen intake, body nitrogen, fecal nitrogen, net protein utilization (NPU), digestibility coefficient (DC) and biological value (BV) of rats fed on pan bread, cake and biscuits experimental diets for 10 days (mean±SD).

Treatment		Net protein utilization %	Digestibility coefficient %	Bailogical value %
Casein		$89.40^{a} \pm 15.55$	$89.47^{a} \pm 1.00$	99.92
Pan bread	1	$70.97^{bc} \pm 4.13$	$86.37^{bc} \pm 0.79$	82.17
	2	$77.73^{abc} \pm 2.15$	$85.10^{c} \pm 3.81$	91.34
	3	$80.17^{abc} \pm 1.06$	$84.89^{c} \pm 1.89$	94.44
Cake	4	$68.77^{c} \pm 4.45$	$88.49^{ab} \pm 1.24$	77.62
	5	$73.45^{abc} \pm 20.49$	$89.38^{a} \pm 2.06$	82.18
	6	$77.67^{abc} \pm 16.92$	$89.40^{a} \pm 1.36$	86.87
Biscutes	7	$70.18^{bc} \pm 9.58$	$87.09^{c} \pm 1.79$	80.58
	8	$78.54^{abc} \pm 8.62$	$84.98^{c} \pm 0.95$	92.42
	9	$85.11^{ab} \pm 0.76$	$88.17^{ab} \pm 0.99$	96.53
L.S.D.		17.22	2.88	

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

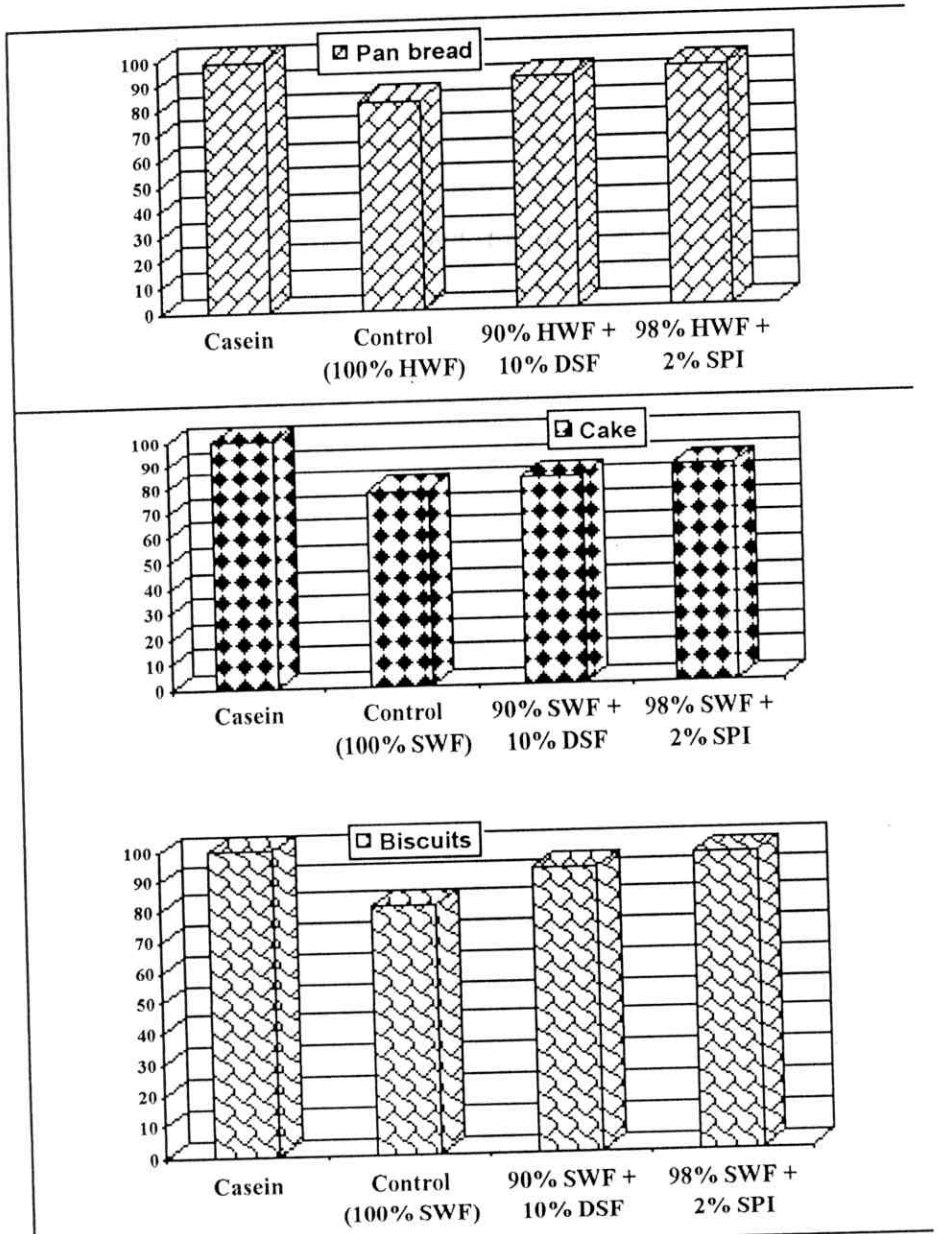


Fig. (12): Effect of diet by pan bread, cake and biscuits on biological value (BV) after 10 days for rats.

The results presented in Table (21) and illustrated in Fig. (13) indicate that the highest value of PER could be seen for the biscuits supplemented with 2% soybean protein isolate, which recorded 1.65. Control pan bread had the lowest PER value (0.58). In addition, there is a significant difference between the control of pan bread and pan bread with defatted soybean and soybean protein isolate.

Also, the PER of cake and biscuits with defatted soybean and soybean protein isolate had the highest values than those of the control samples.

The abovementioned results are in agreement with those obtained by Magbool *et al.* (1987) and Shehata *et al.* (1989) who reported that the supplementation of wheat flour with soybean was found to have high values of PER than those of the control samples.

Conclusion, results of the biological evaluation of the different diets of pan bread, cake and biscuits supplemented with defatted soybean flour and soybean protein isolate had high NPU, DC, BV and PER than the control of pan bread, cake and biscuits.

Table (21): The effect of pan bread, cake and biscuits experimental diets on initial body weight, final body weight, gain body weight, daily body weight increase, total food consumed, total protein consumed and protein efficiency ratio of rats fed for 28 days (mean±SD).

Treatment		Initial weight (g)	Final weight (g)	Gain in weight (g)	Daily increase (g)	Food consumed (g)	Protein consumed	PER*
Casein		82.60^{cd} ±5.03	153.30^{b} ±8.73	70.70^{ab} ±5.23	2.53^{ab} ±0.19	473.02^{ab} ±22.04	47.30^{ab} ±2.20	1.50^{a} ±0.18
Pan bread	1	67.80^{e} ±6.42	94.00^{d} ±8.041	26.20^{c} ±5.32	0.94^{c} ±0.19	452.98^{b} ±4.25	45.30^{b} ±0.42	0.58^{c} ±0.11
	2	73.60^{e} ±11.15	138.04^{bc} ±12.73	64.44^{ab} ±8.79	2.30^{ab} ±0.31	451.80^{b} ±10.19	45.18^{b} ±1.02	1.43^{ab} ±0.16
	3	74.60^{de} ±10.11	114.54^{cd} ±15.47	39.94^{c} ±6.72	1.42^{c} ±0.24	444.58^{b} ±6.72	44.46^{b} ±0.67	0.90^{b} ±0.14
Cake	4	93.80^{ab} ±1.30	147.14^{bc} ±23.63	53.34^{bc} ±23.88	1.91^{bc} ±0.85	479.98^{a} ±8.87	48.00^{a} ±0.89	1.11^{b} ±0.48
	5	90.60^{abc} ±1.82	156.12^{ab} ±13.15	65.52^{ab} ±13.12	2.34^{ab} ±0.47	471.70^{ab} ±22.66	47.17^{ab} ±2.27	1.39^{ab} ±0.27
	6	97.60^{a} ±1.34	172.02^{a} ±7.55	74.42^{a} ±7.30	2.66^{a} ±0.29	476.54^{a} ±10.69	47.65^{a} ±1.07	1.56^{a} ±0.13
Biscuits	7	86.80^{bc} ±1.79	159.24^{ab} ±12.29	72.44^{ab} ±12.01	2.59^{ab} ±0.43	438.50^{b} ±36.15	43.85^{b} ±3.61	1.65^{a} ±0.20
	8	58.00^{f} ±11.46	102.43^{d} ±27.48	44.43^{bc} ±20.24	1.59^{bc} ±0.72	437.65^{b} ±7.50	43.77^{b} ±0.75	1.02^{b} ±0.47
	9	73.40^{e} ±8.91	130.28^{c} ±9.89	57.88^{b} ±12.64	2.07^{b} ±0.45	448.78^{b} ±8.02	44.88^{b} ±0.80	1.29^{b} ±0.57
L.S.D.		8.71	18.39	15.81	0.57	20.90	2.09	0.38

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

* PER calculated in grams as: weight gain/protein consumed

1: Pan bread produced from 100% hard wheat flour (HWF) 72% extraction rate (control).

2: Pan bread produced from 90% HWF + 10% DSF.

3: Pan bread produced from 98% HWF + 2% SPI.

4: Cake produced from 100% soft wheat flour (SWF) 72% extraction rate (control).

5: Cake produced from 90% SWF + 10% DSF.

6: Cake produced from 98% SWF + 2% SPI.

7: Biscuits produced from 100% soft wheat flour (SWF) 72% extraction rate (control).

8: Biscuits produced from 90% SWF + 10% DSF.

9: Biscuits produced from 98% SWF + 2% SPI.

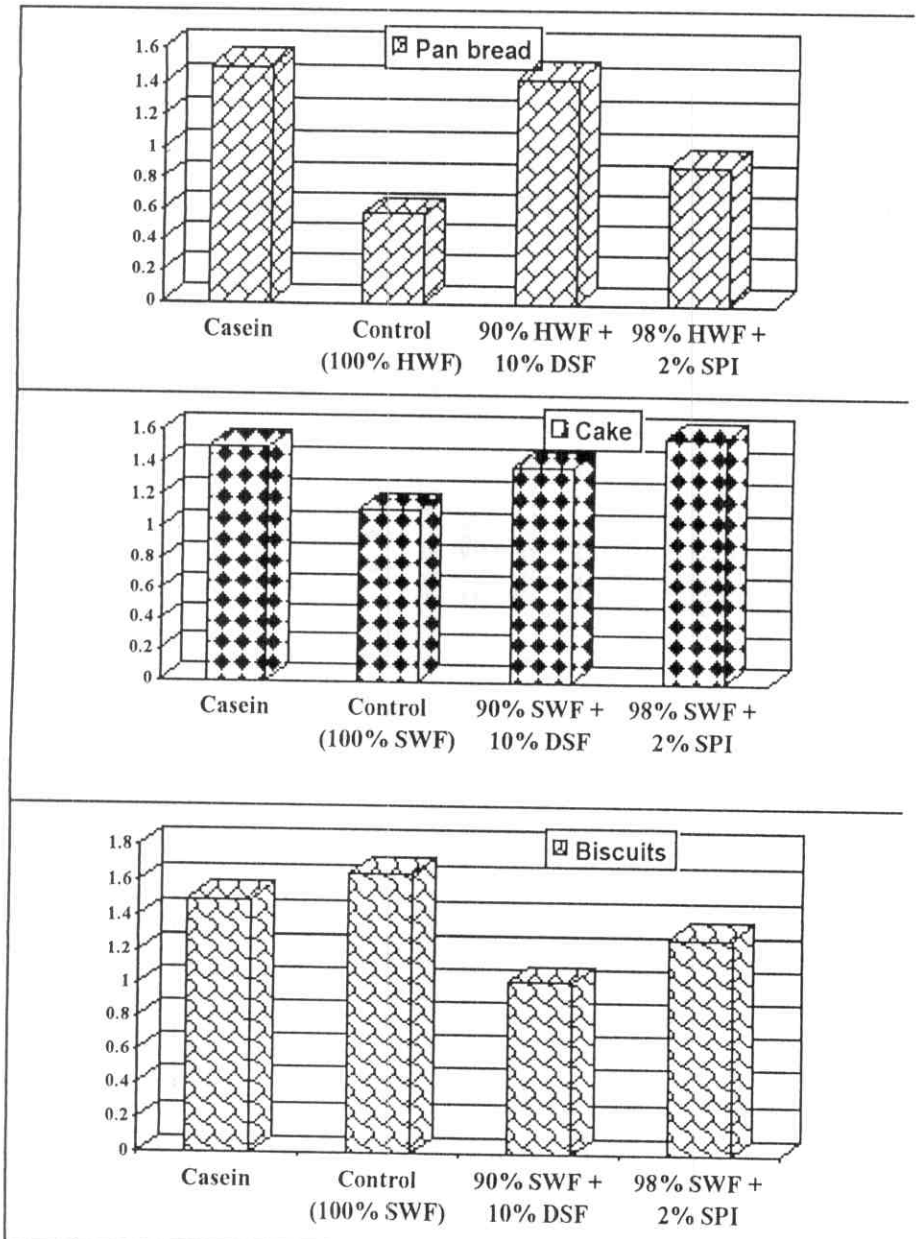


Fig. (13): Effect of diet by pan bread, cake and biscuits on protein efficiency ratio (PER) after 28 days for rats.

4.7. Effect of experimental diets for pan bread, cake and biscuits on total cholesterol, triglycerides and total lipids in blood serum rats:

The effect of feeding rats with all experimental diets for 6 weeks on total cholesterol, triglycerides and total lipids are reported in Table (22) and illustrated in Figs. (14, 15 and 16).

The total cholesterol for all rats at the beginning of the experiment (at zero time) ranged between 56.82 and 59.3 mg/100 ml. At the end of the experiment (6 weeks) the highest level of total cholesterol (95.01 mg/100 ml) was shown for rats fed on control cake followed by control biscuits and control pan bread was 94.72 and 91.76 mg/100 ml, respectively. While the lowest level of total cholesterol was shown for rats fed on pan bread which produced from 98% HWF +2% SPI (69.07 mg/100 ml) followed by cake and biscuits which prepared from 98% SWF + 2% SPI (76.58 and 76.73 mg/100 ml, respectively).

These results are in agreement with those of Nagata *et al.* (1982) who reported that the soybean protein isolate was added to the rat diet and reduced the cholesterol because it decrease of the intestinal sterol absorption in rats.

Also, Saeki *et al.* (1987) found that the undigested materials of soybean protein isolate may interfere with the enterophepatic circulation of bile acids and enhance the elimination of steroids in to faces which may results in the lower level of serum cholesterol.

Concerning the triglycerides level, Table (22) indicated that the triglycerides level at zero time for all rats ranged

Table (22): The effect of pan bread, cake and biscuits experimental diets on total cholesterol, triglycerides and total lipids iof serum blood tested rats.

Treatment		Total cholesterol (mg/100 ml)		Triglycerides (mg/100 ml)		Total lipids (mg/100 ml)	
		Zero time	After 6 weeks	Zero time	After 6 weeks	Zero time	After 6 weeks
Casein		61.43	93.87	47.8	79.2	418	649
Pan bread	1	59.30	91.76	46.3	77.4	402	598
	2	57.40	71.76	47.2	72.5	410	609
	3	58.70	69.07	47.2	69.4	412	600
Cake	4	56.91	95.01	45.9	75.7	405	632
	5	57.47	89.09	46.7	74.2	408	609
	6	57.83	76.58	45.8	71.0	411	593
Biscuits	7	56.82	94.72	46.3	77.7	417	622
	8	57.20	87.26	47.3	73.4	403	596
	9	59.45	76.73	45.7	71.6	406	586

1: Pan bread produced from 100% hard wheat flour (HWF) 72% extraction rate (control).
2: Pan bread produced from 90% HWF + 10% DSF.
3: Pan bread produced from 98% HWF + 2% SPI.
4: Cake produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
5: Cake produced from 90% SWF + 10% DSF.
6: Cake produced from 98% SWF + 2% SPI.
7: Biscuits produced from 100% soft wheat flour (SWF) 72% extraction rate (control).
8: Biscuits produced from 90% SWF + 10% DSF.
9: Biscuits produced from 98% SWF + 2% SPI.

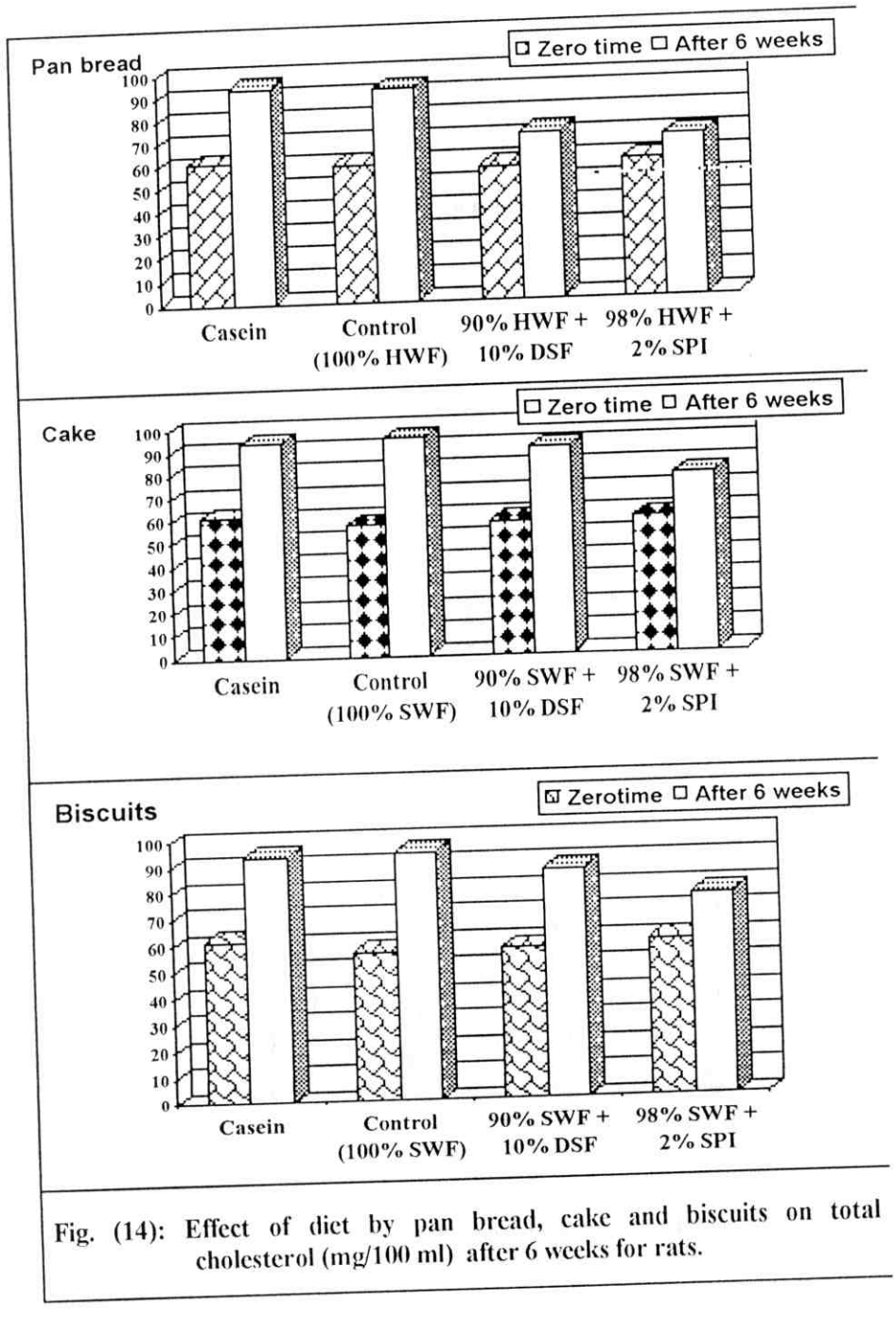


Fig. (14): Effect of diet by pan bread, cake and biscuits on total cholesterol (mg/100 ml) after 6 weeks for rats.

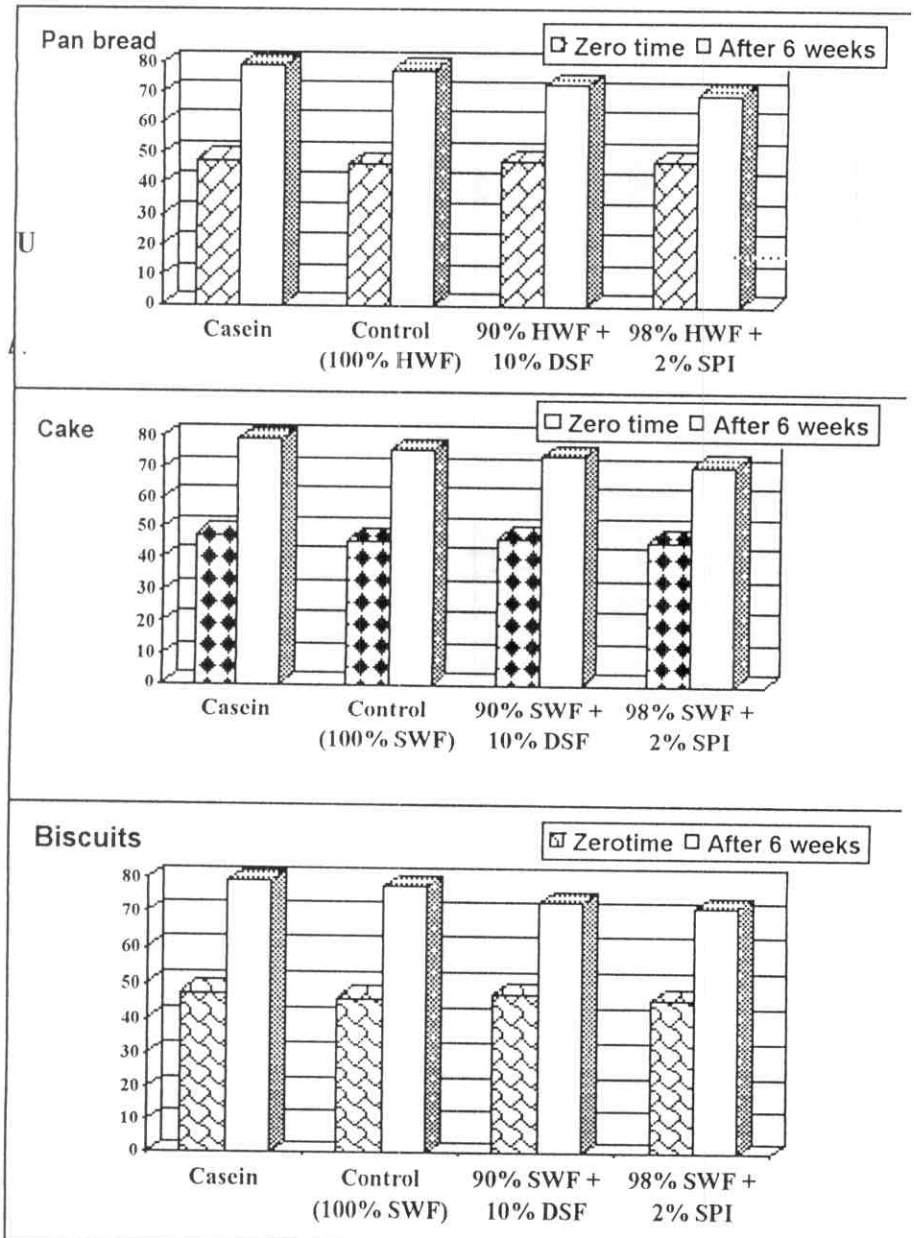


Fig. (15): Effect of diet by pan bread, cake and biscuits on triglycerides (mg/100 ml) after 6 weeks for rats.

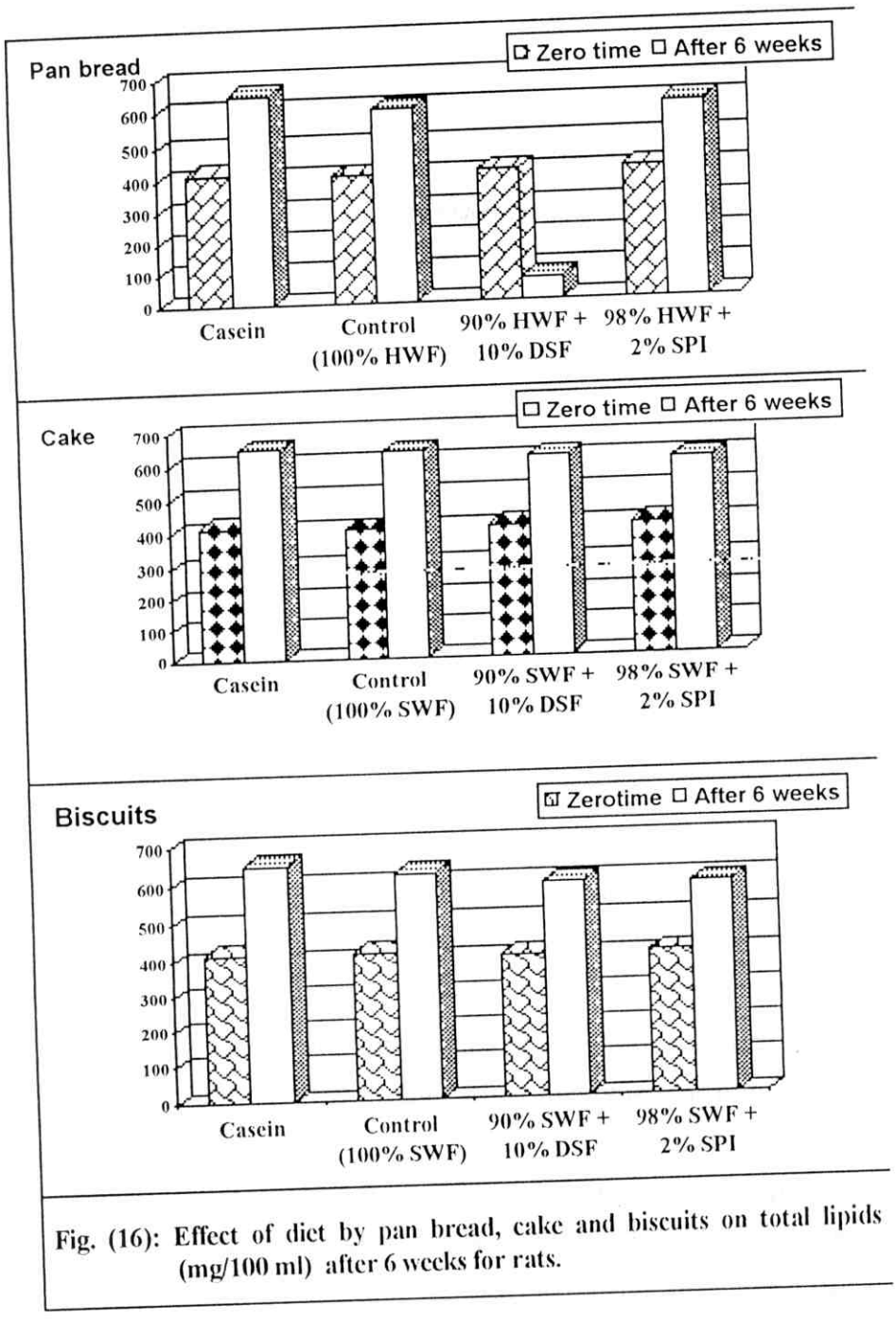


Fig. (16): Effect of diet by pan bread, cake and biscuits on total lipids (mg/100 ml) after 6 weeks for rats.

between 45.7 and 47.3 mg/100 ml. The highest value (77.7 mg/100 ml) of triglycerides was shown for the rats fed on control biscuits, while the lowest value (69.4 mg/100 ml) for the rats fed on pan bread produced from 98% HWF + 2% SPI. Also, cakes and biscuits which contain 98% SWF + 2% SPI given low triglycerides level (71.0 and 71.6% mg/100 ml, respectively).

These results agree with those reported by Zhang *et al.* (1992) who found that soybean protein had lowing effect on triglycerides compared to casein and they suggested that dietary cholesterol have a specific effect on triglycerides metabolism. Either triglycerides synthesis was elevated or triglycerides clearance is lowered.

Regarding the total lipids it could be noticed that, the total lipids at zero time for all rats ranged between (402 and 417 mg/100 ml). The same data in Table (22) showed that the highest total lipids level was 632 mg/100 ml for rats fed on control cake. While the lower values (586 and 593 mg/100 ml) of total lipids were shown for rats fed on biscuits and cake prepared with 98% SWF + 2% SPI, respectively, and this low total lipids values showed decrease compared to the casein.

These results agree with those reported by Abdel-Motaleb (2001) who found that soybean isolate had lowing effect on total lipids compared to casein.

It could be concluded that the groups which fed on pan bread, cakes and biscuits with soybean protein isolate caused decrease in total cholesterol, triglyceride and total lipids in serum more than all diets.