

Table 1. Effect of cinnamon, clove and ginger powders and their essential oils on body and organ weights of experimental diabetic rats

Treatments	Initial (g)	Final (g)	Feed conversion efficiency, (F.C.E) (g gain /g feed)	Liver %	Kidney %	Heart %	Brian %	Spleen %
N. control	154.3 ^a ±0.667	228.0 ^g ±1.155	0.079 ^{ab} ±0.002	3.50 ^c ± 0.174	0.77 ^b ± 0.015	0.32 ^b ± 0.003	0.69 ^a ± 0.042	0.22 ^b ± 0.003
P. control	154.0 ^a ±1.000	188.0 ⁱ ±1.155	0.040 ^b ±0.002	4.60 ^b ± 0.059	1.18 ^a ± 0.061	0.51 ^a ± 0.027	0.68 ^a ± 0.010	0.35 ^a ± 0.012
Diamicron	154.0 ^a ±1.000	205.0 ⁱ ±2.887	0.057 ^{ab} ±0.002	5.06 ^a ± 0.129	1.21 ^a ± 0.107	0.53 ^a ± 0.030	0.66 ^a ± 0.009	0.36 ^a ± 0.022
Powders								
Cinnamon (2.5g)	155.0 ^a ±0.577	249.3 ^c ±1.764	0.098 ^a ±0.002	3.61 ^c ± 0.087	0.77 ^b ± 0.073	0.32 ^b ± 0.022	0.66 ^a ± 0.015	0.24 ^b ± 0.020
Clove (2.5g)	154.0 ^a ±0.577	218.0 ^h ±2.082	0.068 ^{ab} ±0.003	3.64 ^c ± 0.168	0.80 ^b ± 0.033	0.33 ^b ± 0.009	0.65 ^a ± 0.012	0.23 ^b ± 0.000
Ginger (2.5g)	154.3 ^a ±0.333	257.0 ^b ±1.732	0.104 ^a ± 0.001	3.63 ^c ± 0.162	0.82 ^b ± 0.087	0.34 ^b ± 0.024	0.68 ^a ± 0.019	0.24 ^b ± 0.042
Cinnamon+ Clove (2.5g)	153.3 ^a ±0.882	222.7 ^{gh} ±3.180	0.076 ^{ab} ±0.003	3.76 ^c ± 0.075	0.83 ^b ± 0.070	0.35 ^b ± 0.027	0.69 ^a ± 0.012	0.26 ^b ± 0.023
Cinnamon+ Ginger (2.5g)	153.7 ^a ±0.882	222.7 ^{gh} ±1.333	0.075 ^{ab} ±0.002	3.79 ^c ± 0.113	0.79 ^b ± 0.026	0.37 ^b ± 0.022	0.64 ^a ± 0.017	0.25 ^b ± 0.023
Clove+ Ginger (2.5g)	154.0 ^a ±0.577	225.0 ^g ±2.646	0.076 ^{ab} ±0.004	3.60 ^c ± 0.057	0.80 ^b ± 0.072	0.34 ^b ± 0.009	0.65 ^a ± 0.017	0.27 ^b ± 0.035
Cinnamon+ Clove+ Ginger (2.5g)	154.3 ^a ±0.333	228.0 ^{fg} ±2.848	0.080 ^{ab} ±0.005	3.71 ^c ± 0.113	0.80 ^b ± 0.088	0.35 ^b ± 0.015	0.67 ^a ± 0.024	0.26 ^b ± 0.012
Essential oils								
Cinnamon (0.9%)	153.3 ^a ±0.882	262.0 ^b ±3.055	0.094 ^a ±0.003	3.53 ^c ± 0.295	0.79 ^b ± 0.045	0.36 ^b ± 0.033	0.69 ^a ± 0.032	0.25 ^b ± 0.035
Clove (0.9%)	153.7 ^a ±0.667	234.0 ^{ef} ±2.082	0.071 ^{ab} ±0.002	3.51 ^c ± 0.350	0.78 ^b ± 0.052	0.34 ^b ± 0.040	0.65 ^a ± 0.012	0.25 ^b ± 0.055
Ginger (0.9%)	153.7 ^a ±0.667	277.0 ^a ±1.528	0.104 ^a ±0.001	3.43 ^c ± 0.015	0.74 ^b ± 0.069	0.33 ^b ± 0.026	0.67 ^a ± 0.054	0.26 ^b ± 0.027
Cinnamon+ Clove (0.9%)	154.3 ^a ±1.202	242.7 ^d ±2.028	0.075 ^{ab} ±0.001	3.70 ^c ± 0.122	0.81 ^b ± 0.30	0.36 ^b ± 0.026	0.66 ^a ± 0.024	0.25 ^b ± 0.023
Cinnamon+ Ginger (0.9%)	153.7 ^a ±0.882	240.0 ^d ±2.082	0.074 ^{ab} ±0.003	3.68 ^c ± 0.096	0.80 ^b ± 0.052	0.39 ^b ± 0.017	0.69 ^a ± 0.032	0.26 ^b ± 0.023
Clove+ Ginger (0.9%)	154.3 ^a ±1.202	243.0 ^d ±1.528	0.078 ^{ab} ±0.002	3.65 ^c ± 0.130	0.79 ^b ± 0.085	0.31 ^b ± 0.018	0.67 ^a ± 0.020	0.25 ^b ± 0.032
Cinnamon+ Clove+ Ginger (0.9%)	154.7 ^a ±0.882	239.7 ^{de} ±1.453	0.074 ^{ab} ±0.001	3.60 ^c ± 0.061	0.80 ^b ± 0.054	0.34 ^b ± 0.023	0.64 ^a ± 0.022	0.26 ^b ± 0.026
LSD								
	2.061	5.912	0.05259	0.4463	0.1896	0.0744	0.07438	0.07438

- Means, within the same column, followed by the same letter are not significantly different at <0.05.

- Means are followed by the corresponding standard deviation.

Table 3. Effect of cinnamon, clove and ginger powders and their essential oils on serum total cholesterol, HDL and triglycerides levels in experimental diabetic rats

Treatments	TC (mg/dl)	HDL -C (mg/dl)	LDL -C (mg/dl)	VLDL -C (mg/dl)	TG (mg/dl)
N. control	72.50 ^f ± 0.404	48.81 ^a ± 0.335	10.92 ^g ± 0.060	12.73 ^f ± 0.046	63.67 ^g ± 0.242
P. control	184.3 ^a ± 1.016	36.17 ^f ± 0.242	119.9 ^a ± 0.490	27.36 ^a ± 0.055	136.8 ^a ± 0.272
Diamicron	79.53 ^d ± 0.421	44.64 ^c ± 0.081	18.08 ^d ± 0.472	16.63 ^d ± 0.023	83.16 ^e ± 0.115
Powders					
Cinnamon (2.5g)	85.55 ^c ± 0.867	40.17 ^d ± 0.185	26.34 ^c ± 0.733	19.13 ^c ± 0.058	95.67 ^{cd} ± 0.286
Clove (2.5g)	86.00 ^c ± 0.139	39.56 ^{de} ± 0.208	26.82 ^c ± 0.257	19.25 ^c ± 0.064	96.29 ^{cd} ± 0.318
Ginger (2.5g)	85.89 ^c ± 0.410	39.90 ^d ± 0.242	26.53 ^c ± 0.247	19.06 ^c ± 0.046	95.30 ^d ± 0.231
Cinnamon+ Clove (2.5g)	86.81 ^c ± 0.162	39.95 ^d ± 0.029	27.19 ^c ± 0.043	19.24 ^c ± 0.046	96.23 ^{cd} ± 0.223
Cinnamon+ Ginger (2.5g)	86.29 ^c ± 0.251	39.59 ^d ± 0.177	27.19 ^c ± 0.569	19.10 ^c ± 0.035	95.52 ^{cd} ± 0.171
Clove+ Ginger (2.5g)	86.71 ^c ± 0.075	39.78 ^d ± 0.046	27.21 ^c ± 0.054	19.29 ^c ± 0.032	96.46 ^c ± 0.162
Cinnamon+ Clove+ Ginger (2.5g)	90.40 ^b ± 0.398	38.94 ^e ± 0.368	31.47 ^b ± 0.821	19.72 ^b ± 0.101	98.66 ^b ± 0.508
Essential oils					
Cinnamon (0.9%)	78.85 ^{de} ± 0.514	45.63 ^b ± 0.502	16.25 ^{ef} ± 0.046	16.48 ^{de} ± 0.087	82.40 ^{ef} ± 0.433
Clove (0.9%)	79.20 ^{de} ± 0.185	45.73 ^b ± 0.098	16.56 ^e ± 0.239	16.55 ^{de} ± 0.043	82.75 ^{ef} ± 0.208
Ginger (0.9%)	78.91 ^{de} ± 0.084	45.80 ^b ± 0.318	16.52 ^e ± 0.290	16.38 ^e ± 0.061	81.94 ^f ± 0.308
Cinnamon+ Clove (0.9%)	78.55 ^{de} ± 0.185	45.85 ^b ± 0.029	15.81 ^{ef} ± 0.271	16.43 ^{de} ± 0.097	82.19 ^{ef} ± 0.498
Cinnamon+ Ginger (0.9%)	78.25 ^e ± 0.144	45.88 ^b ± 0.046	15.34 ^f ± 0.056	16.51 ^{de} ± 0.040	82.57 ^{ef} ± 0.201
Clove+ Ginger (0.9%)	78.13 ^e ± 0.277	45.77 ^b ± 0.058	15.56 ^{ef} ± 0.229	16.48 ^{de} ± 0.098	82.42 ^{ef} ± 0.491
Cinnamon+ Clove+ Ginger (0.9%)	78.18 ^e ± 0.364	46.25 ^b ± 0.260	15.22 ^f ± 0.133	16.46 ^{de} ± 0.218	82.32 ^{ef} ± 1.087
LSD					
	1.118	0.6548	1.066	0.2292	1.145

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- Means are followed by the corresponding standard deviation.

Table 4. Effect of cinnamon, clove and ginger powders and their essential oils on the liver function and kidney function levels in experimental diabetic rats

Treatments	Liver functions			Kidney functions	
	ALT (U/L)	AST (U/L)	ALP (U/L)	Urea (mg/dl)	Creatnen (mg/dl)
N. control	22.05 ^g ±0.237	28.80 ^g ±1.426	70.85 ^h ±0.387	22.69 ^f ±0.178	0.071 ^e ±0.085
P. control	56.49 ^b ±1.311	67.64 ^b ±63.164	278.6 ^b ±1.975	62.73 ^a ±2.537	1.307 ^a ±0.033
Diamicron	59.37 ^a ±1.241	81.00 ^a ±0.452	290.5 ^a ±1.120	52.39 ^b ±0.473	1.223 ^{ga} ±0.026
Powders					
Cinnamon (2.5g)	27.77 ^d ±1.236	35.64 ^d ±0.600	121.2 ^e ±2.194	40.83 ^d ±0.229	0.980 ^b ±0.012
Clove (2.5g)	28.14 ^{cd} ±0.600	37.87 ^{cd} ±1.247	123.7 ^d ±1.184	40.61 ^d ±0.407	0.966 ^{bc} ±0.019
Ginger (2.5g)	27.68 ^d ±1.951	36.55 ^d ±1.680	122.8 ^{de} ±1.801	40.71 ^d ±0.809	0.970 ^{bc} ±0.012
Cinnamon+ Clove (2.5g)	28.37 ^{cd} ±0.096	36.48 ^d ±0.191	121.2 ^e ±0.346	41.58 ^d ±0.203	0.980 ^b ±0.046
Cinnamon+ Ginger (2.5g)	27.86 ^d ±0.043	36.12 ^d ±0.086	121.4 ^{de} ±0.332	40.69 ^d ±0.197	0.960 ^{bc} ±0.017
Clove+ Ginger (2.5g)	28.63 ^{cd} ±0.266	38.26 ^{cd} ±0.110	122.3 ^{de} ±0.315	42.32 ^d ±0.146	0.993 ^b ±0.026
Cinnamon+ Clove+ Ginger (2.5g)	30.10 ^c ±0.058	39.73 ^c ±2.633	132.7 ^c ±1.241	47.90 ^c ±0.428	1.223 ^a ±0.032
Essential oils					
Cinnamon (0.9%)	24.63 ^f ±2.044	32.51 ^f ±0.064	86.74 ^f ±2.610	35.81 ^e ±0.227	0.843 ^d ±0.029
Clove (0.9%)	25.29 ^f ±1.796	32.90 ^{ef} ±1.617	87.88 ^f ±1.472	35.90 ^e ±0.398	0.850 ^d ±0.012
Ginger (0.9%)	24.97 ^f ±1.045	31.74 ^f ±0.878	87.14 ^f ±1.236	35.86 ^e ±0.047	0.853 ^d ±0.018
Cinnamon+ Clove (0.9%)	25.34 ^f ±0.123	32.78 ^{ef} ±0.344	87.45 ^f ±0.318	36.41 ^e ±0.120	0.880 ^d ±0.012
Cinnamon+ Ginger (0.9%)	24.62 ^f ±0.192	32.62 ^f ±0.215	86.34 ^{fg} ±0.127	34.65 ^e ±0.084	0.856 ^d ±0.020
Clove+ Ginger (0.9%)	25.54 ^{ef} ±0.225	33.00 ^{ef} ±0.289	87.65 ^f ±0.226	35.66 ^e ±0.241	0.860 ^d ±0.035
Cinnamon+ Clove+ Ginger (0.9%)	23.82 ^{fg} ±1.951	30.29 ^{fg} ±1.259	84.08 ^g ±0.456	35.51 ^e ±0.324	0.806 ^d ±0.027
LSD					
	2.214	2.861	2.266	1.978	0.09109

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- Means are followed by the corresponding standard deviation.