The Effect of Natural Falling and Dipping of House Fly (*Musca domestica)* on the Microbial Contamination of Water and Milk: A Short Communication Report

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Abstract

Background: The study describes the comparison of different microbial load results of natural falling and dipping of the house fly (*Musca domestica*) in water and milk to investigate the possibilities of preventing the effect of the transferred pathogens from the house fly to our sources by pointing out the existence of antimicrobial factors within the house fly.

Methods: Samples of house fly were collected from Jeddah and Makkah (Makkah region) and were directly transferred to the laboratory. Each house fly was packed in sterile test tubes. Each tube was opened oppositely to a larger test tube containing 10 ml of sterile tap water, and sterile water at pH 4.0 in other similar series of treatments to represent the reactions of stomach fluids. Later, the house flies were left for 20 seconds after reaching the water surface, and then cultured on different microbial media to evaluate the microbial load of the natural falling of the house fly. To evaluate the complete dipping of house flies in the water, two methods were tested by one complete dip for the flies for 20 seconds, and three times complete dipping for 20 seconds in water before evaluating the microbial load. The same methods were achieved on milk in a series of experiments and the microbial load was evaluated after the

incubation at room temperature for three hours.
Results: It was found that dipping treatments of house flies gave lower microbial contamination in water at pH 4.0 than neutral pH. The lower microbial load was also observed when dipping the house flies three times in water as compared to once dipping and natural falling treatments. It was also found that the complete dipping of house flies' treatments in milk will reduce the microbial contamination as compared to natural falling treatments.
Conclusion: The observed results support the presence of antimicrobial factors on the house fly.

Contributions to the literature

- This report summarizes the study made by **(Baeshin *et.al.*, 1990)** to point out the precedence of exploring the results of the study.
- The study describes the effect of the natural falling and dipping of the house fly in water and milk on both pathogenic and non-pathogenic microorganisms.
- The results suggest the existence of antimicrobial agents on the house fly, which opens the doors of the exploration of promising antimicrobial agents to serve in food hygiene and other public health categories.

Keywords: *house fly, falling, dipping, antimicrobial, milk, water.*

Background

House flies may carry non-pathogenic or pathogenic microorganisms and may also possess and transfer many antimicrobial factors that act against many of these microorganisms in addition to many enzymes that can affect the pathogenic microorganisms. Studies of the microorganisms on the wings of the house fly, as well as effect of dipping the house flies in edible liquids for human consumption such as milk and water need to be conducted as we preceded in this area (**Baeshin *et al.*, 1990).** Recently, a study was demonstrated on the molecular levels by **(Sudong *et al.*, 2021)** to pinpoint the nature and structure of some antimicrobial factors within house fly known as

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antimicrobial peptides (AMPs), which has a significant role of such molecular diversity in the housefly antimicrobial immune systems.

According to Food and Drug Administration (FDA), house flies and other pests may transport about 25% of foodborne infections which are reported annually such as Enterohemorrhagic colitis, shigellosis, salmonellosis, and cholera **(Olsen *et al.*, 2001)**.

House flies may acquire food borne microorganisms from the residues of infected persons such as vomitus, stools, and body. On the other hand, house fly disseminated microorganisms through; direct contact, feces, and mouth secretions **(Baeshin *et al.*, 1990; Mead *et al.*, 1999)**.

In the present article, we are aiming to summarize our previous findings of the effect of dipping the house fly in consumable liquids and the existence of antimicrobial factors in the house fly.

Material and Methods

Samples collection

Samples of house fly (*Musca domestica*) were collected from Jeddah and Makkah and were directly transferred to the laboratory to compare between the natural falling and dipping of house fly in water and milk. Each house fly was packed in sterile test tubes.

Natural falling and dipping experiments in water

The sterile tubes containing the house flies were opened oppositely to larger sterile test tubes containing 10 ml sterile water and started dropping one by one of the house flies. The tubes were left for 20 seconds before culturing on different microbial media. The experiments were applied in two different methods; the first method was by using the same house flies in the natural falling and dipping treatments, and the second method was by using different house flies in each treatment of dipping and natural falling. The dipping treatments were also divided into two methods; the first method was by one complete dip for the flies for 20 seconds, and the second method was by three times complete dipping for 20 seconds in water.

The microbial load of the contaminated water was determined directly after falling or dipping by incubation of 15, 30, 45 and 60 minutes at room temperature on nutrient agar to determine the total microbial flora. Non-haemolytic and haemolytic flora were determined on blood agar. The experiments were applied in neutral sterile tap water and sterile water at pH 4.0.

Natural falling and dipping experiments in milk

Another series of natural falling and dipping experiments of house flies were carried out on sterile milk and the microbial load was determined after incubation at room temperature for 3 hours.

Results and Discussion

Natural falling and dipping in water

The obtained data showed in table (1) which declared the comparison between natural falling and dipping once and triple for 60 minutes. The results evident showed that natural falling resulted in higher contamination than dipping. Thus, when the fly was tested by dipping it will carry less amount of microbial flora. This may explain the higher counts observed in natural falling treatments. On the other hand, as presented in table (2), the results declared that after dipping or falling in sterile water for separated house flies in each treatment, the triple dipping treatment gave lower counts in microbial load than those reported for natural falling and once dipping samples. This indicates the remarkable effect of dipping when compared to natural falling as the house fly was washed in the surface water from most of the microorganisms and antimicrobial factors in the natural falling treatment, and still showed lower microbial counts after the dipping treatments. Also, the incubations time at room temperature before culturing was shown to be effective as the long period of incubation allows the reaction between microorganisms and microbial factors to happen and subsequently the reduction of the microbial count. Furthermore, the once and triple dipping in sterile water at pH 4.0 showed generally lower counts than the natural falling treatments, which indicates that the antimicrobial factors were still effective at pH 4.0.

Natural falling and dipping in milk

Our findings show that the falling of house fly in sterile milk had a higher contamination level than the insects dipping which refers to the presence of some antimicrobial agents on the surface of house fly which descending in water, during dipping treatments as illustrated in table (3). More remarkable findings were noticed in the means of bacterial counts after the dipping and falling treatments at different incubation periods as presented in table (4), which declared that dipping treatments gave a considerably lower value. Although milk is an excellent medium for the proliferation of almost all microorganisms, the obtained results pointed out a progressive decline in different microbial counts after falling or dipping treatment, and this supports the suggestion of the presence of antimicrobial agents on the house fly.

Some previous studies **(Atta, 2014)** pointed out similar results, which revealed that all media cultivated with right-wing extract were free of bacterial and fungal growth, however, the left-wing had bacterial and fungal growth. This would conclude that the right fly wing is a new antibiotic revolution that needs more investigation in order to discover other antibiotics from the right fly wing. Recently, **(Sudong *et al.*, 2021)** unveiled the nature of some antimicrobial agents on the house fly at the molecular level**.** Therefore, it is worthwhile to investigate more in this field seeking for potentially now antimicrobial factors and antibiotics.

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Incubation Period (min)	pH of Water	Total Microbial Flora				Non-Haemolytic Bacteria				Haemolytic Bacteria			
		Natural falling	Dipping once	Natural falling	Dipping three	Natural falling	Dipping once	Natural falling	Dipping three	Natural falling	Dipping once	Natural falling	Dipping three
0	7.0 (Natural)	1950	1530	2625	2700	270	735	978	750	105	68	1350	849
15		1288	1208	1827	1343	311	288	776	567	63	93	524	734
30		1144	808	1291	1036	184	256	612	510	44	32	543	288
45		297	450	1131	1338	68	108	507	390	14	23	324	418
60		-	-	729	1034	-	-	297	278	-	-	432	368
0	4.0	1575	525	3900	4200	135	38	1260	405	293	375	75	780
15		1163	334	3626	1850	242	138	575	851	127	92	-	161
30		192	144	4556	1632	180	60	320	-	72	120	40	32
45		77	54	1922	1016	41	23	180	249	32	20	80	8
60		50	30	1342	1854	20	12	38	54	20	10	8	8

Table1: Effect of natural falling and dipping of house fly in sterile water on counts of total bacterial flora, non-haemolytic and haemolytic microorganisms (mean of five replicates – counts/ml). (Baeshin *et.al.*, 1990).

Incubation Period (min)	pH of water	Total microbial flora			Non-Haemolytic bacteria			Haemolytic bacteria		
		Natural falling	Dipping once	Dipping three	Natural falling	Dipping once	Dipping three	Natural falling	Dipping once	Dipping three
0	7.0 (Natural)	360	1340	510	340	710	180	40	110	80
15		512	1112	376	168	592	240	79	32	64
30		240	450	96	216	234	96	30	42	8
45		192	450	96	104	348	16	8	52	8
60		84	232	30	42	148	10	10	2	8
0	4.0	3399	2100	3699	2700	2100	2499	949	949	499
15		4927	2089	3168	-	199	1275	-	439	660
30		3039	2089	1215	1177	912	1368	342	417	351
45		864	591	2928	1471	1440	1248	639	480	624
60		-	909	1377	1507	-	850	259	-	273

Table 2: Effect of natural falling and dipping of separate house flies in sterile water on counts of total microbial flora, non-haemolytic and haemolytic microorganisms (mean of five replicates – counts/ml). (Baeshin *et.al.*, 1990).

Microflora	Falling		Dipping	
	Total	Mean	Total	Mean
Total microbial flora	13440	790.6	2805	165.0
Non-haemolytic microorganisms	12910	759.4	4250	250.0
Haemolytic microorganisms	3790	222.9	715	42.1

Table 3: Counts of total microbial flora, non-haemolytic and haemolytic microorganisms as influenced by falling and dipping of house flies in sterile milk, counts/ml (17 samples). (Baeshin *et.al.*, 1990).

Microflora	Falling				Dipping			
	Incubation period (hr)				Incubation period (hr)			
	0	1	2	3	0	1	2	3
Total Microflora								
1- Total	3660	4620	5200	8420	2640	2200	3800	5840
2- Mean	366	462	520	842	264	220	380	584
Non-haemolytic bacteria								
1- Total	4180	3520	3620	4640	3020	2740	3600	3360
2- Mean	418	352	362	464	302	274	360	336
Haemolytic bacteria								
1- Total	800	720	2480	1360	440	640	1520	1080
2- Mean	80	72	248	136	44	64	152	108

Table 4: Effect of incubation period on the counts of different microorganisms in contaminated milk with natural falling and dipping house flies (counts/ml). (Baeshin *et.al.*, 1990).

Conclusion

The observed results support the presence of antimicrobial agents on the house fly, which is a promising research field that might open the doors for the discovery of novel promising antimicrobial agents that may serve particularly in food science and generally in the fields of medicine, pharmaceuticals, and public health.

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