Global Veterinaria 4 (4): 331-336, 2010
ISSN 1992-6197

Quality of Buffaloe's Meat Infected with Sarcocysts

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Abstract: Although buffaloes meat is one of the most important sources of animal protein for a wide range of consumers, but unfortunately there is a wide spread of Sarcocysts in their meat, such infection often results in much economic losses in addition to it is possible zoonosis to human. This study was planned to investigate the possible additional harmful effect of such parasite on meat quality. The obtained resuls revealed a noticeable increase in the total aerobic count, total enterobacteriaceae count, moisture percent, ash percent and pH value and marked decreases in the protein and fat percents of infected samples as compared with the non infected samples. Also, results revealed that parasitism has no significant effect on the number of *Staphylococcus aureus* or total mould and yeast. In conclusion, Sarcocysts in buffaloes meat cause serious changes which may greatly lower the meat quality, lowering its grade and may render it completely unacceptable

Key words: Quality · Sarcocysts · Buffalo meat · Bacterial load

INTRODUCTION

One of the most serious problems among animals is the parasitic infection which is not affect the general health condition of animals only but also can cause certain diseases in human. Sarcocysts infection is common in buffaloes worldwide as nearly all adult buffaloes are infected with some Sarcocysts species in certain countries as India [1].

It is known that people can serve as final host for species of *Sarcosporidia* whose intermediate host is cattle (*Sarcocysts hominis* [2]or *Sarcocystis bovinominis* [1].

Man also is an intermediate host of some unknown sarcocystic species [3]. Volunteer infection in man have shown that *Sarcocystis hominis* is only mild pathogenic in humans, causing nausea, stomach pain and diarrhea. [4]

AS regulations decide, carcasses heavily infected with Sarcocysts are totally rejected, but that of light infection, can pass for human consumption after partial trimming without restriction.

The question raised is that is this meat pass for human consumption after partial trimming of the parts contained the sarscocysts have the same quality of meat obtained from healthy non infected animals?

This work aimed to compare the quality of meat from infected and non infected animals, from the microbiological and chemicals points of view

MATERIALS AND METHODS

Collection of Samples: A total number of 70 random samples from freshly slaughtered buffaloes meat (40 samples infected with Sarcocysts and 30 samples from non infected meat) was collected from different abattoirs of El-Gharbia and Kafrelsheikh governorates, Egypt. The infected samples were identified according to Soulsby [5].

The samples were transferred to laboratory under a septic condition with minimum time of delay in an ice box to be examined microbiologically and chemically.

Microbiological Examination:

- Preparation of samples were carried out as outlined by APHA [6].25 grams of each sample was homogenized in a blender of 14000 rpm for 2.5 minutes together with 225 mL of sterile buffer peptone water 0.1% to obtain homogenate of 1/10 dilution, from which further decimal dilutions were prepared.
- Determination of total aerobic bacterial count was carried out as outlined by APHA[6]. 0.1 mL from each dilution was evenly spread over the dry surface of standard plate count agar using a sterile bent glass spreader. Only plates contain 30-300 colonies were counted as the total colony per gram of sample.

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- Determination of total enterobactericeae count was carried out as outlined by ICMSF [7].0.1 ml from each dilution was evenly spread even the surface of violet red bile glucose (VRBG) agar. The plats then overlaid by pouring another 5 mL of the medium. After solidification, the plates were incubated at 37°C for 48 hours. Red or purple colonies surrounded by a zone of precipitated bile were counted as total enterobacteriaceae count.
- Determination of *Staphylococcus aureus* count was carried out as outlined by APHA [8]. A loopful from each previously prepared serial dilutions was spread over the dry surface of baird panker agar incubated at 37°C for 48 hours. Plates showing black colonies surrounded by a clear zone were recorded.
- Determination of yeast and mould count was carried out as outlined by APHA [8].1 mL of each dilution was mixed thoroughly with milted sabaroud dextrose agar at 45°C, after solidification, the plates were incubated at 25°C and examined after 3, 5 days as the yeasts and moulds were counted separately.

Chemical Examination: Determination of pH was carried out as outlined by Pearso [9].

Chemical Composition of Meat:

- Determination of protein percentage was carried out as outlined by AOAC [10].
- Determination of fat percentage was carried out as outlined by AOAC [10].
- Determination of ash percentage was carried out as outlined by AOAC [10].
- Determination of moisture percentage was carried out as outlined by FAO [11].

Statistical Analysis: Statistical analysis was done using least significant difference (LSD) [12].

RESULTS

Table 1 shows effect of sacrocyst infection on the total aerobic bacterial count of examined meat samples. Significant increase in the total aerobic bacterial count in the meat infected with sarcocysts.

The highest frequency of normal meat samples (60%) contain bacteria ranged from $10^4<10^5$ while 55% of infected samples contain $10^6 \leq 10^7$ bacteria/gram (Table 2)

Table 3 shows an increase in the enterobacriaceae count in meat infected with sarcocysts.

The highest frequency of normal meat samples contain $<10^4$ enterobacteriaceae/gram, while that of infected samples contain $10^5<10^6$/gram (Table 4).

Table 5 shows non-significant increase in the *Staphylococcus aureus* count between infected and normal meat samples.

The highest frequency of normal meat samples and infected meat samples contain *Staphylococcus aureus* ranged from $10^5 \leq 5 \times 10^5$ microorganism/gram (Table 6).

Table 7 shows non-significant increase in the total yeast and mount count in meat infected with sarcocycts.

Table 1: Effect of sacrocyst infection on the total aerobic bacterial count (cfu/g) of examined meat samples

	No. of examined	Positive samples		cfu/gm		
Samples	samples	No.	%	Min.	Max.	Mean ± SE
Non infected samples	30	30	100	1.8×10^4	2.03×10^6	$7.41 \times 10^5 \pm 1.36 \times 10^5$
Infected sample	40	40	100	1.01×10^5	1.64×10^7	$2.21 \times 10^6 \pm 6.30 \times 10^5$*

* Significant difference

Table 2: Effect of infection with sarcocysts on frequency distribution of the examined meat samples based on their total aerobic count

	Normal samples		Sarcocysts infected samples	
Classes cfu/g	Frequency	%	Frequency	%
$< 10^4$	0	0	0	0
$10^4 \leq 10^5$	18	60	2	5
$10^5 \leq 10^6$	10	33.33	16	40
$10^6 \leq 10^7$	2	6.67	22	55
$10^7 \leq 10^8$	0	0	2	5
Total	30	100	40	100

Table 3: Statistical analytical results of total enterobacteriaceae count (cfu/g) of examined meat samples

Samples	No. of examined samples	Positive samples		Count/g		
		No.	%	Min.	Max.	Mean ± SE
Non infected samples	30	18	60%	1×10^3	3.1×10^5	$1.15 \times 10^5 \pm 1.62 \times 10^4$
Samples infected with Sarcocysts	40	39	97.5	1.2×10^4	9.7×10^5	$2.50 \times 10^5 \pm 4.3 \times 10^4$

Table 4: Effect of infection with sarcocysts on frequency distribution of the examined meat samples based on their total enterobacteriaceae count

Classes cfu/g	Normal samples		Sarcocysts infected samples	
	Frequency	%	Frequency	%
$< 10^4$	14	46.67	0	0
$10^4 \leq 10^5$	12	40	7	17.5
$10^5 \leq 10^6$	4	13.33	33	85.5
Total	30	100	40	100

Table 5: Effect of infection with sarcocysts on *Staphylococcus aureus* count (cfu/g) of examined meat samples

Samples	No. of examined samples	Positive samples		Count/g		
		No.	%	Min.	Max.	Mean ± SE
Non infected samples	30	11	36.6	1×10^4	7.1×10^5	$5.96 \times 10^4 \pm 2.56 \times 10^4$
Samples infected with Sarcocysts	40	19	47.5	1×10^4	9.65×10^5	$9.82 \times 10^4 \pm 3.1 \times 10^4$

Table 6: Effect of infection with sarcocysts on frequency distribution of the examined meat samples based on their *Staphylococcus aureus* count

Classes cfu/g	Normal samples		Sarcocysts infected samples	
	Frequency	%	Frequency	%
Negative	19	63.33	21	52.5
$10^4 \leq 5 \times 10^4$	1	3.33	4	10
$5 \times 10^4 < 10^5$	3	10	4	10
$10^5 \leq 5 \times 10^5$	6	20	9	22.5
$5 \times 10^5 \leq 10^6$	1	3.33	2	5
Total	30	100	40	100

Table 7: Effect of infection with sarcocysts on yeast and mould count (cfu/g) of examined meat samples

Samples	No. of examined samples	Positive samples		Count/g		
		No.	%	Min.	Max.	Mean ± SE
Non infected samples	30	16	53.3	3×10^3	9.2×10^5	$2.09 \times 10^5 \pm 4.97 \times 10^4$
Samples infected with Sarcocysts	40	32	80	1.11×10^4	1.52×10^6	$3.12 \times 10^5 \pm 5.75 \times 10^4$

Table 8: Effect of infection with sarcocysts on frequency distribution of the examined meat samples based on yeast and mould count

Classes cfu/g	Normal samples		Sarcocysts infected samples	
	Frequency	%	Frequency	%
Negative	14	46.67	8	20
103	0	0	0	0
$10^4 \leq 5 \times 10^4$	1	3.33	7	17.5
$5 \times 10^4 \leq 10^5$	1	3.33	2	5
$10^5 \leq 5 \times 10^5$	9	30	9	22.5
$5 \times 10^5 \leq 10^6$	5	16.67	12	30
$10^6 \leq 5 \times 10^6$	0	0	2	5
Total	30	100	40	100

Table 9: Effect of infection with sarcocysts on of protein percent of examined meat samples

Samples	No.	Min.	Max.	Mean ± S.E
Non infected samples	30	16.99	18.02	17.97 ±0.0339
Sarcocysts infected sample	40	13.21	17.84	16.22 ± 0.132**

** = Highly significant difference

Table 10: Effect of infection with sarcocysts on fat percent of examined meat samples

Samples	No.	Min.	Max.	Mean ± S.E
Non infected samples	30	0.93	4.39	2.33 ±0.215
Sarcocysts infected sample	40	0.31	3.22	1.50 ± 0.134**

** = Highly significant difference

Table 11: Effect of infection with sarcocysts on ash percent of examined meat samples

Samples	No.	Min.	Max.	Mean ± S.E
Non infected samples	30	0.99	1.23	1.17 ± 0.0106
Sarcocysts infected sample	40	1.15	1.72	1.53 ± 0.017**

** = Highly significant difference

Table 12: Effect of infection with sarcocysts on moisture percent examined meat samples

Samples	No.	Min.	Max.	Mean ± S.E
Non infected samples	30	75.99	81.59	77.91 ± 0.297
Sarcocysts infected sample	40	78.13	84.39	81.62 ± 0.23**

** = Highly significant difference

Table 13: Effect of infection with sarcocysts on pH value of examined meat sample

Samples	No.	Min.	Max.	Mean ± S.E
Non infected samples	30	5.01	5.56	5.31 ± 0.0191
Sarcocyst infected sample	40	5.69	6.09	5.93 ± 0.021**

** = Highly significant difference

The highest frequency of normal meat contain mould and yeast at level of $10^5 \leq 5x10^5$ while that of infected samples were 5 x 10^5-10^6 gram (Table 8).

Table 9 shows a significant (P<0.01) decrease in the protein percent in meat infected with sarcocysts.

Table 10 shows highly significant (P<0.01) decrease in fat percent in meat infected with sarcocysts.

Table 11 shows highly significant (P<0.01) increase in the moisture percent in meat infected with sarcocysts.

Table 12 shows highly significant increase (P<0.01) in the pH value in meat infected with sarcocysts.

Table 13 shows highly significant (P<0.01) increase in the pH value in meat infected with sarcocysts.

DISCUSSION

The results presented in Table 1 revealed significant increase in the total aerobic bacterial count of meat samples infected with Sarcocysts which may due to the high stress resulting from parasitic infection which lead to immune depression which is a good chance for bacterial multiplication [13].

Results achieved in Table 2 showed that 55% of meat samples infected with Sarcocysts contain the greatest number of bacteria in comparison with the others while only 0% of non infected samples have the same number. This result may show a direct relation between parasitic infection and bacterial load as meat infected with parasites have a great probability of higher bacterial contamination [11].

The data tabulated in Table 3 indicated that 97.5% of infected samples were contaminated by enterobacteriaceae, in comparison with 60% of non infected ones that show the same level of contamination. Table 4 clearly showed the significant increased level of enterobacteriaceae (count and percent) in infected samples comparing with the non-infected ones. This may be attributed to the health disturbance and the immune suppression resulting from parasitism flourishing the multiplication of such bacteria which commonly inhabit the intestinal tract of animals that facilitate its migration from intestine to various body tissues[5].

Data in Table 5 show that *Staphyloccus aureus* was presented in 47.5% of meat samples that infected with Sarcocysts while it present in 36.6% only of non infected

samples. On the other hand, table 6 demonstrate that the highest frequency distribution based on *Staphyloccus aureus* count of meat infected with Sarcocysts was (22.5%) while, in non infected meat samples was (20%).

These results in table 6 showed non-significant increase in the *Staphylococcus aureus* count in infected meat samples and this may be attributed to the fact that presence of *Staphylococcus aureus* is mainly from contamination of carcasses during slaughtering and preparation either from animal or human sources [7]. Internationally the percent and level of contamination with staphylococci are most commonly related to the hygienic standards adopted during dressing and preparation of food animals carcasses[11].

Eighty percent of infected meat samples were contaminated with yeast and mould in comparison with only 53.3% of non-infected samples (Table 7). Also, 30% of infected samples have yeast and mould at a range of $5 \times 10^5 \leq 10^6$ in comparison with 16.67% of non-infected samples have the same range (Table 8). Such results in tables 7 and 8 indicated that a non significant increase in the total yeast and mould in infected meat may be attributed to the fact that the level of carcasses contamination with mould and yeasts depends mainly on the level of environmental pollution with the fungal spores[14]as the hygienic standards applied during slaughtering have the superior role in controlling the level of mould, yeast contamination [10].

Data recorded in Table 9 revealed highly significant reduction in the total protein percent in meat samples infected with Sarcocysts in comparison with non infected meat samples which may be attributed to the adverse effect of such parasite on muscles constituents resulting from oedema and mayositis which lower muscle protein [15].

The recorded results (Table 10) show that total fat % were significantly lower in infected samples than non infected one. These results may be attributed to weakness and loss of appetite of infected animals which lead to excessive utilization of body fat and consequently lowering fat in their meat [16].

Data in Table 11 revealed that the ash % was higher in infected samples than non infected ones. This may be attributed to the relative decrease in the dry matters (protein, fat) in infected animals as a result of lipolysis and proteolysis and consequently increase in the inorganic matter concentration which is considered the main component of ash [17].

Results recorded in Table 12 showed that the moisture percents were significantly higher in infected samples than non infected samples which may be attributed to excessive loss of fat and protein and accumulation of fluids in the tissues (oedema) resulting from infection with this parasite.

From the results recorded in Table 13 there is highly significant increase of pH value in infected meat samples, this may attributed to the adverse effect of the parasite on biological activity of muscle which retard muscle contraction and hardening, so decrease the ability to produce lactic acid by glycolysis and incomplete muscle acidity (incomplete rigor mortis), also the increase of pH value in infected meat may be due to its high moisture content [18].

From the previous results it could be concluded that parasitism with sarcocystis increase the bacterial load of carcase, moisture percent and pH value, lower its protein and fat percentages. Such serious effects greatly lower the meat quality and may render it completely unacceptable.

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