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Research Article

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Novel Routing Algorithm for Efficient Packet Transmission in MANET using T –Test Procedure and Sleep and Awake Strategy

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Abstract
Packet transmission is one of the time-consuming communication processes in a mobile ad hoc network. Many routing pathways may encounter failed packet delivery as a result of the MANET node's power backup. The routing algorithm determines the path packets follow as they travel from the source to the destination nodes, but it provides no assurances about packet delivery. This work suggested a new routing method that uses the T-test procedure to discover the most effective path between nodes. This proposed technique recursively identifies the optimum way between nodes for communication, ensuring that each node participating in route discovery has enough energy for transmission.. The T-Test procedure defines and supports the criteria for evaluating the nodes that are chosen and rejected during the route discovery process. This technique, in conjunction with T-Test, enables successful packet transmission in MANET packet flows with sleep and awake strategies. It is also developed using network simulation and compared to the present routing system, indicating that it performs better overall.

Keywords: MANET, Sleep and Awake Strategy, Routing Algorithm, T-Test,

1. Introduction

An ad hoc network's topology is dynamic, nodes in a mobile ad hoc network (MANET) are unaware of their network's topology and must figure it out on their own. According to the fundamental criteria, whenever a new node joins an ad hoc network, it must broadcast an announcement of its presence and must also pay heed to analogous announcement broadcasts from existing mobile nodes.

Proactive routing systems are sometimes known as table-driven routing protocols. Every mobile node has its own routing database, which lists the routes to all potential destination mobile nodes. Because the topology of a mobile ad hoc network changes often, these routing tables are routinely changed. Its downside is that it struggles with large networks since storing route information to every potential node causes the routing table entries to become excessively large.

Reactive routing systems are sometimes known as on-demand routing protocols. In this type of routing, the path is only discovered when it is required. To accomplish route discovery, route request packets are disseminated over the mobile network. Its two fundamental aspects are route discovery and route maintenance.

A t-test is used in statistics to compare the means of two groups. It is commonly used in hypothesis testing to assess whether two groups vary or whether a method or treatment has an effect on the population of interest. The null hypothesis (H0) asserts that there is no difference between these group means. The actual difference, according to the alternative theory (Ha), is not zero.

A t test (also known as a pairwise comparison) should be used only when comparing the means of two groups. If you want to compare more than two groups or perform several pairwise comparisons, use an ANOVA test or a post-hoc test. The t test is a parametric difference test, which implies that its conclusions are based on the same premises as other parametric tests. The t test assumes that your data are comparable in terms of variation within each group being compared, independent, and (nearly) consistently distributed (also known as variance homogeneity).

MANET Routing Protocol Characteristics

To avoid routing difficulties in MANET, routing protocols should have the following characteristics:

• It should be widely distributed.
• Localization is required.
• It should be adaptive to frequent changes in topology caused by node mobility.
• It must be free of impassable paths.
• The paths must shortly converge.

Performing a T- test

The t test evaluates the true difference between two group means by dividing the difference in group means by the total standard errors of both groups. It can be calculated automatically or manually using statistical analysis software and a formula test equation

The formula for the two-sample t test, also known as the Student's t-test, is provided below.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{(s^2(\frac{1}{n_1} + \frac{1}{n_2}))}}$$

t represents the test statistic, x1 and x2 represent the two groups being compared, s2 represents the combined standard error of the two groups, and n1 and n2 represent the number of observations in each group. A larger t value implies a more significant difference between groups since the difference between group means is greater than the pooled standard error.

2. Relevant Work

Because MANETs are dynamic, there are resource, routing, and stability difficulties, all of which are vulnerable to various attacks. The present literature study highlights the importance of energy conservation as a critical aspect in routing algorithms for network performance and proposes an effective energy algorithm based on the shortcomings of existing energy protocols. The protocols demonstrate the significance of routing in networks and explain the various routing algorithm approaches provided by MANET. Furthermore, it introduces and investigates network security issues, describes intrusion detection methods for network attacks, and proposes improving the energy technique by including a security algorithm.

The network performs badly due to the MANET architecture's fragmented and often dynamic nature. The capacity of this routing protocol to swiftly discover the best paths between sources and destinations ensures that data is transmitted reliably and within the time limit specified. The route path's establishments must adhere to the least amount of overhead. Current routing methods are built for static environments and are incapable of adapting to often changing topologies, resulting in poor convergence, throughput, route loops, overhead, and congestion [1]. This should be enhanced; thus the routing should be properly explored. Security policy methods have been developed for the many types of infrastructure networks.

It is a significant task to implement these policies in MANETs apps. To establish secure paths between source and destination, the authors used a piece of their research on secure routing algorithms [1]. Global Transitions Proceedings 3 (2022), R. Prasad and Shivashankar. The authors of paper proposed a method that minimises overall energy usage while also enhancing network networking lifetime by combining compressive sensing techniques with network coding in the sensor network. By establishing the virtual coordinates, it decreases the energy required to ensure a long-lasting network. This procedure must also accommodate a changing network environment [2].

The research evaluated the energy consumption parameters that affect network longevity. Among the energy consumption factors are the expected energy sources, the energy placement target, and the frequency and latency of data aggregation energy network concentration. A single sink location outperforms several sink sites with limiting network mobility. [3,4].

Although this algorithm consumes the least amount of energy, it fails in high-speed connections because it broadcasts. Messages are constantly passing via the network, and the total overhead is significantpresented a technique for limiting the nodes' energy threshold for message forwarding [5]. The authors presented energy-efficient routing, which builds with multiple route paths in decreasing order, measures the energy levels of each road, introduces new paths, and extends network lifetime [6]. When constructing the paths, the conventional DSR routing protocols do not take energy into account. Both AODV and DSR make efficient use of resources, save energy, and allow mobile ad hoc network architectures/organizations to self-organize, self-configure, and move. Nonetheless, with limited abilities, more flexible, and Nodes in the setup should fulfil the trust tier and routing tier for information transfer [7]. If the node is not prepared to recognise these levels, it will be unable to join the network.

Following the distribution of inquiries over the network, each node can accept one route request from another node. These policy enforcement mechanisms are primarily meant to create safe network paths and routing; nonetheless, they fall short in defending against malicious nodes and various types of attacks. It was described in the study how to build secure channels by broadcasting information hop by hop to authenticate nodes [8]. The network's security protocol then validates end-to-end performance metrics using a symmetric key generated device. Many academics have focused on problems with secure routing paths that use the least amount of energy for transmission and have also raised security concerns about it, but they are ineffectual and struggle when dealing with various types of real-time attacks.

In MANET, there are two sorts of attacks: active and passive. Passive attacks are most common in the TCP/IP network levels and data connection layers. Such attacks have no effect on how the network runs because they ingest packet information from available network nodes. Typically, attacks send data while exchanging information. These assaults have a lower impact on the network than active attacks. These attacks produce disturbances such as information spying, packet loss, and misinformation about nodes. Eavesdropping, jamming, selfish behaviour, traffic analysis, and traffic monitoring are all examples of passive attacks.

Active attacks involve nodes purposefully changing route patterns and traffic, slowing transmission and congesting networks. Because of this characteristic, active attacks are sometimes referred to as routing attacks. Performance is low as a result of the difficulties in identifying and mitigating these types of attacks. Worm-hole, black-hole, flooding, spoofing, and gray-hole attacks are examples of current attacks. Such protections can only be built with a thorough understanding of the dangers.

The Enhanced Energy Efficient Secure Routing (EEE-SR) protocol approach, an algorithm that identifies the lowest shortest energy path for data transmission to network nodes with secured network data communication, has been devised and applied in the proposed study attempt. This technique's greater energy efficiency boosts network throughput and network longevity. This algorithm includes energy-efficient management techniques, allowing it to make greater use of the nodes' available energy.

3. T-Test and Sleep and Awake Strategy Routing Algorithm

This article's unique routing approach follows the procedures involved in MANET routing operations, such as route request and route discovery. Finding the device's remaining power for picking the path from source to designation is one of the new aspects of the newly defined algorithm, and the nodes operate in two modes: sleep and awake. This will be specified by the area nodes, with one node sleeping and the others waking.

Sleep and Awake Node Selection

1. All the nodes sends a beacon signal to other nodes to receive the current location and battery power
2. Upon receiving the beacon signal other nodes shares the current location .
3. Each and every node find out the nodes within the transmission range based on the location
4. Form a cluster nodes which are in the same region .
5.Choose the head nodes which posses the high battery power in the same region
6. Head nodes define the list of sleep nodes and awake node
7. Send information to other nodes in the region and start routing process

The Algorithm's Phases

1. Have the MANET's source node send a route request RREQ to every node that contains the destination node.
2. Obtain the Route Response from the other nodes in order to communicate with the destination.
3. Determine the remaining power of each node along its path from the source to the destination.
4. Using the T-Test Procedure, approve or reject the node for route discovery.
5. Remove rejected nodes and select a new transmission path.
6. Finish the transmission's chosen path.

T-Test Methodology

The number of nodes participating in the first route discovery will be defined for n, and the total number of nodes in the MANET will be defined for N. The T-Test approach defines the Hypothesis. Selected nodes have more power than residual nodes. Rejected nodes identify which nodes have less remaining power.

Residual Power >=H0 is the True Hypothesis.

Residual Power: False Hypothesis H1

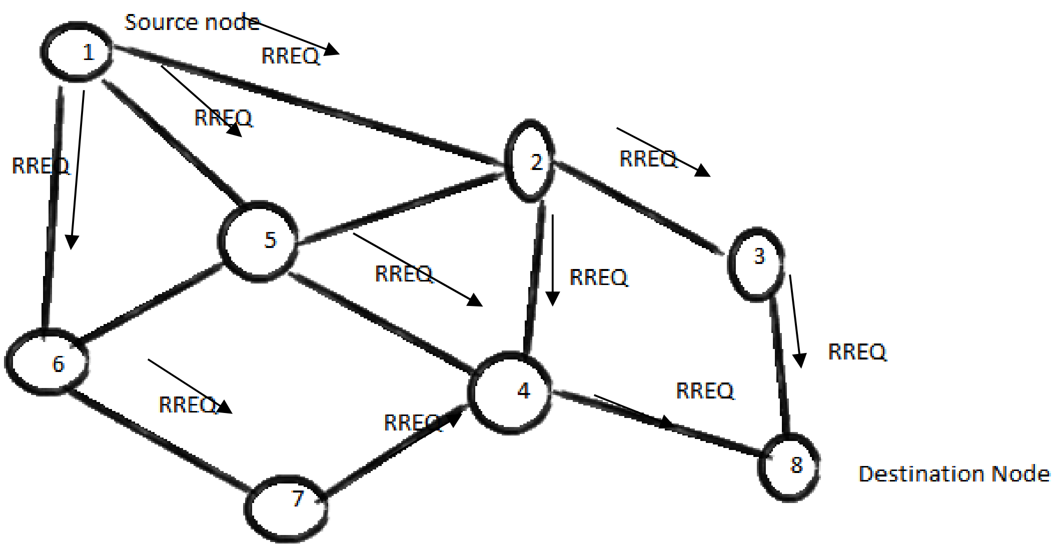

Figure 3.1: Request Route from Source to Destination Node

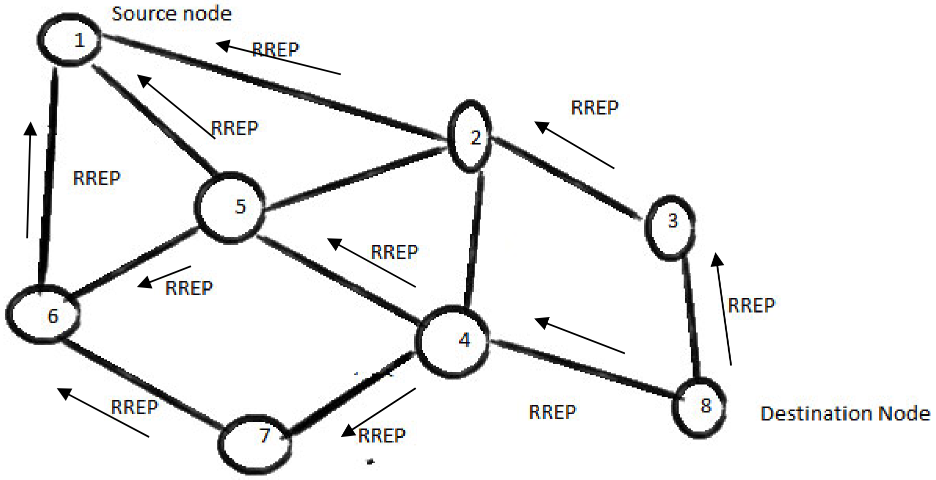

Figure 3.2: Reply Route from Destination Node to Source Node

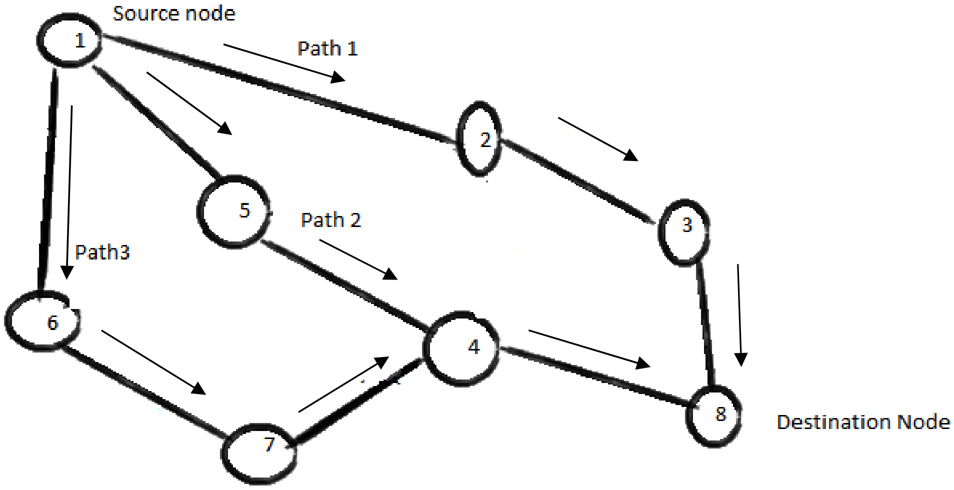

Figure 3.3: Alternative Path from Source to Destination

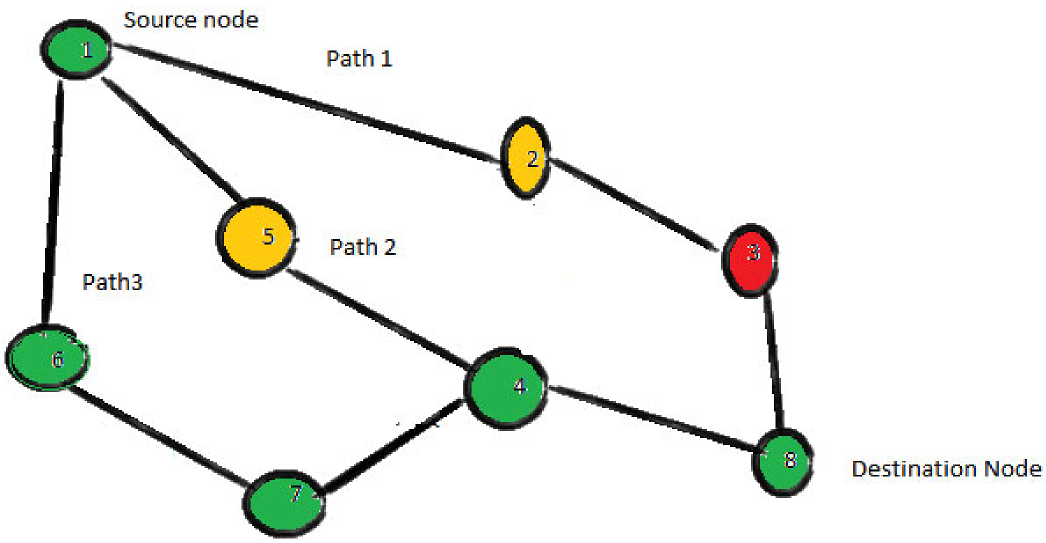

Figure 3.4: Residual Power on Two Different Paths from the Source to the Destination

The working principle of the proposed algorithm is represented in Figures 3.1 to 3.4, where a route Request is delivered from the source node to the destination node. The route reply is sent by the destination node to the source node, as shown in Figure 3.2. Figures 3.3 and 3.4 demonstrate the identification of different paths and the selection of the way that has enough energy to transport the packet, which is done by utilising the T-test process with the help of residual power availability in each node.

4. Simulation

The suggested routing algorithm is implemented in NS- 2 Simulator version 2.34. The simulation area is 500X 500 mm, and the number of nodes is 50, 100, and 150 with stop times of 5s, 15s, and 25 sec and average speeds of 10.10 m/s, 21.25 m/s, and 12.02 m/s, respectively. Table 1 shows the entire simulation setup for the MANET investigation.

Parameter Setup	Data set
Total nodes	150, 200,250,300
Name of the source node	5
Simulation time Set	100s
Default break time	5s ,10s, 15s, and 25 sec
speed	11.10 m/s , 11.25 m/s and 14.02 m/s
Traffic Type	CBR
Size of the Packet	512 byte

Table 1: Examination Simulation Setup

Table 2 displays the defined parameter value with constant bit rate traffic while estimating the Energy model for the MANET protocol performance. The omni antenna is used to determine the routing path and packet transmission. Initially, all nodes established an ideal energy of 200 joules, and other required power is also estimated and assigned, as shown in table 2.

Parameter	Defined
MANET Network Interface	Wireless Physical Interface
Medium Access Control type	802.11
Type of Channel	Wireless channel
Propagation method	TWO WAY GROUND
Antenna Defined	Omni Antenna
Frequency Set	280.8 mW (250 m)
Initial node Energy	240 Joule
Rest Power	1.5W
Receiving packet Power	1.0W
Transmission packet Power	1.5w

Table 2: Energy Model Parameter Specifications

5.Result and Discussion

The suggested routing algorithm is compared to the existing AODV protocol since the AODV is an on-demand protocol that supports defining the optimum path between source and destination.

To locate the route discovery, the source node sends the Route Request to all nodes and waits for the router response. Figure 5.1 shows a comparison of route request and route reply with the existing AODV Protocol.

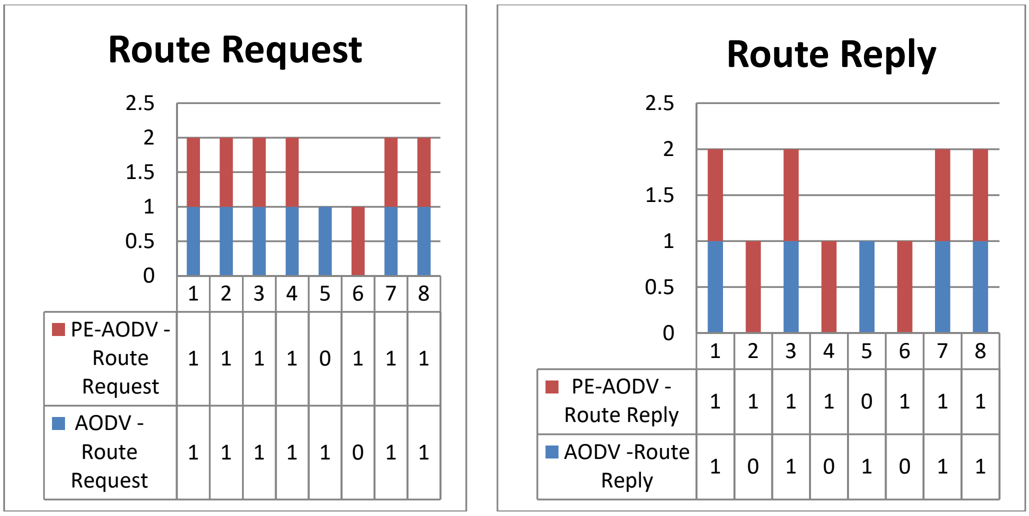

Figure 5.1: Request for Route

Route Exploration

At this step, the suggested approach is critical for selecting the most power-efficient node for packet transmission.Using the T Test Procedure, each node's residual power is evaluated, and the node path with the most energy is chosen. The comparison for taking the time to select the optimum path is made with the AODV protocol, which indicates a little delay in path selection in the PE AODV protocol. This delay is manageable and has no effect on the MANET's performance, as demonstrated in Figure 5.2. Finally, the protocol performance parameters are summarised in Figure 5.3.

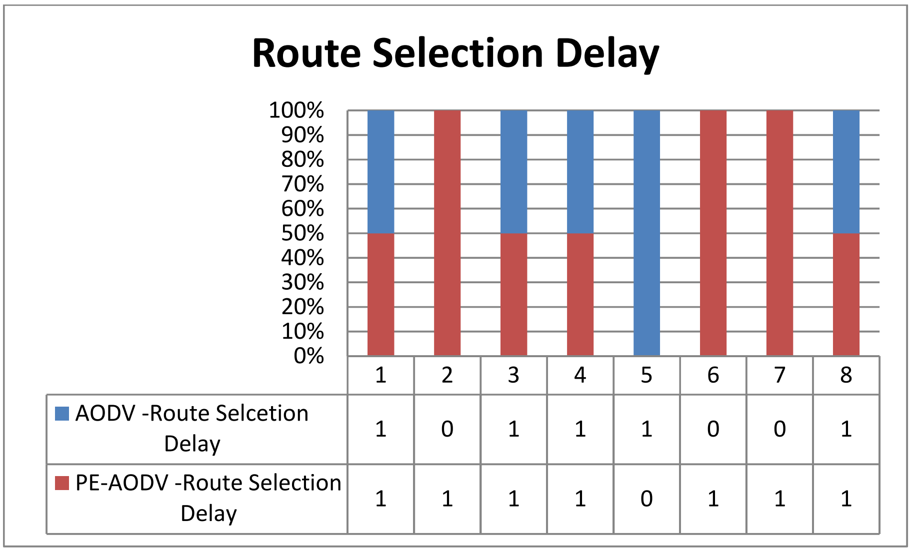

Figure 5.2: Route selection Delay

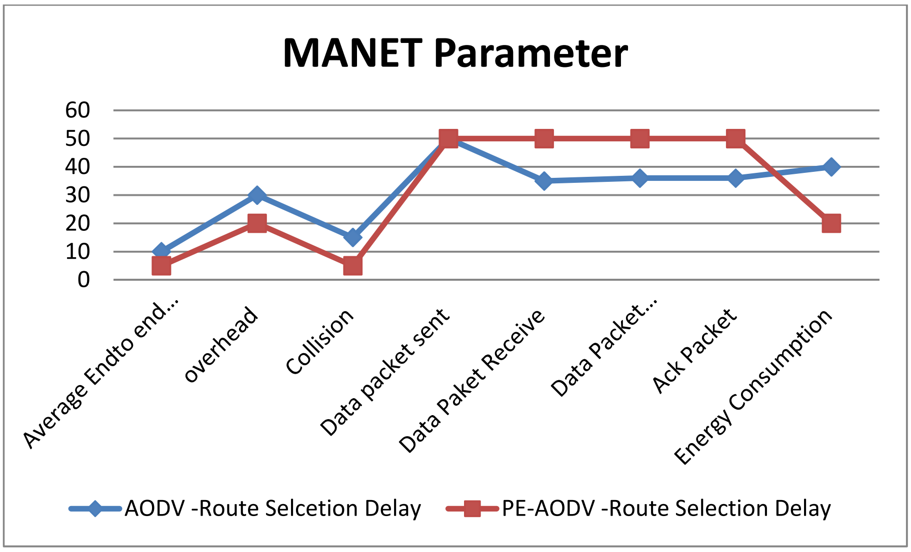

Figure 5.3: Parameter Comparisons

6. Conclusion

The Routing Algorithm for Efficient Packet Transmission in MANET Using T -Test Procedure is constructed with the help of a Network Simulator, and the results were compared with the current protocol, which showed that it performed better than the other MANET protocols. The T-Test is crucial in determining the best path along the trip.This protocol could be incorporated as a feature in the Making new protocol stack for the MANET network layer route finding.

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4. Discussion

The overall prevalence of mastitis from CMT test in this study was 24.5%. This prevalence is appreciable and may be attributed to the general low level of hygiene observed in the clinical and farm inspection. However, this prevalence is lower compared to 30.5% reported by Umoh et al., 2007 for traditional dairy herds in Plateau State and 37.0% by Umoh et al., 1990 in a study carried out in Kaduna and Zaria which is the same study area with this study [8].

The difference could be due to the fact that while the other studies collected milk from nomadic Fulani herds only, the present study collected milk from both the traditional small holder farms and the large mechanized dairy farms, whose hygiene measures were higher. Also the sample collection for this study was carried out during the dry season (January to April). This is the period known to record low prevalence of organisms and also the period during which the pH of milk tends to be low, which inhibits the growth of most organisms [9].

However, the result is consistent with the 25.4% reported by Zouharova (2009) in Aydin, Turkey. The prevalence observed in individual farms showed the large mechanized dairy farms to have lower figures than their corresponding small holder dairy farms within the same sampling area. For instance, is was 18.0% and 18.3% in Kaduna large mechanized dairy farms but a prevalence of 30.0 – 61.0% was recorded for the small holder farms around Kaduna. This may be attributable to the fact that the large mechanized dairy farms adopted better farm management practices compared to the small holder dairy farms as evidenced in the outcome of farm inspection.

The prevalence of subclinical mastitis observed in the bulk milk samples, 16.7% and 3.3% were in conformity with the reported 15.9% of Strastkova *et al;* (2009) in Czech Republic in bulk tank milk and the 3.2% reported among nomadic herds by Umoh *et al;* (1990 a) [8]. The lower detection rate of mastitis in the bulk milk samples compared to the quarter milk was probably due to substantial dilution of contaminated milk and this helped to substantially reduce the likelihood of detection as reported by Strastkova *et al;* (2009).

The bacteriological quality of the fresh raw cow milk samples showed a high total staphylococcal count beyond the standard recommended by the American Public Health Association (APHA, 2001) which is Grade A raw milk (<10^5 cfu/ml) and Grade B (milk from local producers) (<10^6 cfu/ml). the counts for LMDF Kaduna ($\log_{10}$ 4.00 cfu/ml), SHDF Kaduna ($\log_{10}$ 5.87 cfu/ml), SHDF Zaria ($\log_{10}$ 5.97 cfu/ml) and LMDF Zaria ($\log_{10}$ 6.03 cfu/ml) were all too high, showing that the milk samples were contaminated with bacteria. Only the counts of the bulk milk samples ($\log_{10}$ 2.23 cfu/ml) and swab samples ($\log_{10}$ 1.43 cfu/ml) are within the standard range.

Abid *et al.,* 2009 reported that counts greater than 10^3 cfu/ml for raw milk indicates a serious fault in hygiene, the overall mean staphylococcal colony count of $\log_{10}$ 4.26 cfu/ml in this study therefore is relatively high and indicative of a milk that has suffered from bacterial contamination. The source of contamination in this study could be attributed to unsatisfactory condition of the housing for the cattle, poor sanitary procedures, and or secondary contamination from the skin, mammary gland and nasal cavity of the cows. Contamination could also be from the poor state of health of the milk animals (which could be habouring clinical or subclinical mastitis) and the bacterial causal agents from the udder may get into the milk.

The high level of association observed between CMT and staphylococcal count (table 12) is not surprising because according to the findings of Eldeeb and Hassan (1987) total bacterial count increase when milk tests positive for mastitis. In the same vein, bacteria that causes mastitis not only contaminate the milk but multiply and grow in the milk due to the fact that the milk is highly nutritious and serves as an excellent growing medium for a wide range of bacteria.

Mastitis has been reported as the most significant disease of the dairy industry, causing serious economic losses and species of staphylococcus especially *Staphylococcus aureus* was named as one of the most important causative agent all over the world. In the same vein, Hammed *et al.,* (2006) found in a study conducted in Egypt that 16% of all mastitis cases were caused by *Staphylococcus aureus*.

From the biochemical tests and the subsequent Microgen identification, *Staphylococcus aureus* was the most prevalent organism with 38%. This high detection rate may be due to its contagious nature, which has made it a major udder pathogen in many parts of the world, causing both subclinical and clinical mastitis [11]. This high percentage of *Staphylococcus aureus* agree with the result of Zubbeir and Elowni (2006) who got 34% from cattle in a similar study in Sudan.

The isolation of *Staphylococcus aureus* is of public health significance since it is a commonly recovered pathogen of food poisoning due to milk and milk products [11].

The other Staphylococcus species (CoNS) detected in this study included *Staphylococcus chromogenes* (18.0%) *Staphylococcus haemolyticus* (4.0%) *S. hyicus* (19.0%) *S. epidermidis* (4.0%) *S. cohnii* (2.0%) *S.xylosus* (8.0%) and *Staphylococcus intermedius* (8.0%).

This result agreed with that of Mahmmoud and Shamoon (2009) who isolated these similar bacteria from bovine mastitis in Iraq. It also agreed with the findings of Taponen *et al.,* (2006) who reported that among researches, isolation of *Staphylococcus chromogenes, Staphylococcus epidermidis* and *S. simulans* seem to be the most common coagulase negative staphyclococcus species (CNS) isolated from intra mammary infections inspite of some variations between herds, countries and methods [14].

Bovine CNS have traditionally been considered as skin flora opportunists and have also been isolated from the cow's environment [12]. *Staphylococcus chromogenes* was frequently isolated from the teat, skin and teat canal but also from extra mammary sites like nares, hair coat and vagina of cattle [13].

According to Matos *et al;* (1991) *Staphylococcus cohnii, S.saprophiticus* and *S. xylosus* were among the most common in the cow's environment such as in hay and beddings while Staphylococcus *haemolyticus* is an occasional pathogen of mastitis.

5. Conclusion

There was a high total Staphylococcal count (up to 6.03 ± 0.20 $\log_{10}$cfu/ml) which indicated a high level of milk contamination from unsatisfactory milking practices, this poses a health hazard of food borne infection to consumers through the food chain. The CMT value was about 25%, which is quite appreciable and this equally poses a threat of consumption of mastic milk from consumers and its attendant consequences. Different Staphylococcus species were isolated and identified from milk and dairy workers some of which include *Staphylococcus chromogenes* (18%), *S. intermedius* (8%), *S. haemolyticus* (4%) with *Staphylococcus aureus* being the most prevalent (38%). This is of public health significance because of its association with food poisoning in milk and milk products.

Recommendations

Dairy farmers should be educated by Government Agricultural Agencies and other stakeholders like Veterinary and Microbiology experts on the need to improve their level of hygiene in milk production and handling, through workshops, seminars and so on.

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