The Benefits of Teat Dipping as Prevention of Mastitis

Yanuartono¹, Alfarisa Nururrozi¹, Soedarmanto Indarjulianto¹*, Hary Purnamaningsih¹, Dhasia Ramandani²

¹Department of Internal Medicine, Faculty of Veterinary Medicine, Universitas Gadjah Mada.
²Department of Biotechnology and Veterinary, Vocational College, Universitas Gadjah Mada

*) Corresponding author:
E-mail: indarjulianto@ugm.ac.id

Abstract

Mastitis is the major disease and the most costly disease of the dairy industry worldwide. One of the mastitis control programs that until now has been carried out and proven to be quite effective is the teat dipping method as a form of prevention. Various methods and uses of teat dipping solutions have been widely used and used for this purpose such as iodine, potassium permanganate, chlorhexidine, chlorhexidine gluconate chloride, iodophor, sodium hypochlorite, lactic acid, phenolics and Dodecyl Benzene Sulfonic Acid (DDBSA). Pre milking and post milking teat disinfection have been recommended widely by veterinarians and adopted by dairy producers in increasing numbers. This procedure is simple to perform, economical, and effective in controlling contagious mastitis pathogens. More recently, teat dipping in association with good udder preparation reduced the rate of intramammary infections by environmental pathogens. This paper aims to provide a brief review of the benefits of teat dipping as a method of controlling the incidence of mastitis in dairy cows.

Keywords: mastitis, teat dipping, pathogens, intramammary infections

Introduction

Management of dairy farming is implemented to improve milk quality and safety. The management implementation includes sanitation equipment, hygiene milking, environmental cleanliness, air source, feed, animal health, and milk processing after milking (Izquierdo et al., 2017). Mastitis is a major problem in the management of livestock businesses throughout the world, including Indonesia (Nurhayati and Martindah, 2015). These problems are related to economic losses that occur due to an increase in poor milk quality, a decrease in milk production, an increase in maintenance costs, an increase in the number of animals that are culled before their age even severe them to death (Majic et al., 1993; Samad, 2008; Bogni et al., 2011). Therefore, proper control and management of mastitis in herds is an indispensable effort to ensure animal health and safety of dairy products. During the last few decades, more advanced mastitis control and management have been developed, however, this disease is still a major problem in a dairy farming business (Fetrow et al., 1991; Bhuotto et al., 2012). Eberhart and Buckalew (1972) and Schmidt et al., (1985) added that pathogens originating from the environment can increase the number of clinical mastitis sufferers during the livestock period in accordance with a well-designed control system.

One of the mastitis control and management which has been carried out and proven to be quite effective is the teat dipping method as a form of prevention...
Oliver et al. (2001) stated that teat dipping is a simple procedure and does not require expensive costs. Teat dipping, both before and after milking is the most effective procedure for preventing the occurrence of new mastitis in dairy cows (Contreras et al., 2003). The procedure involves a teat dipping method using a germicidal antiseptic to reduce contamination and colonization of bacteria that cause mastitis in the nipples and minimize penetration into the streak canal or nipple canal. The use of teat dipping for mastitis control in dairy cows was first reported by Moak in 1916 to control the infection of Streptococcus agalactiae. At that time the dipping solution used was pine oil (Barnum et al., 1982). Teat dipping using disinfectant is now widely recommended by animal health practitioners and has been widely implemented by dairy farmers since it can be done easily, cheaply and effectively for the control and control of pathogens of environmental origin as a cause of infectious mastitis (Oliver et al., 1993; Oliver et al., 2001).

To date, the most commonly used solutions for teat dipping are iodine 0.25%, 0.5% and 1% (Nickerson et al., 1986; Oliver et al., 1993), chlorhexidine 0.5% (Schultz and Smith, 1972), chlorine 4% (Gleeson et al., 2009), Iodophore 0.5% (Kamal and Bayoumi, 2015), sodium hypochlorite (Hemling, 2002), phenolics (Oliver et al., 2001), Dodecyl Benzene Sulfonic Acid (2015 DDBSA) 1.94% (Barnum et al., 1982), potassium permanganate (Yasothai, 2017; Abinaya and Thangarasu, 2017), bronopol (Boddie and Nickerson, 2002) and hydrogen peroxide (Leslie et al., 2006). Alternative solutions that have been studied and are useful for teat dipping consist of Morinda citrifolia extract (Purwantiningisih et al., 2017), starfruit leaf extract, or Averrhoa bilimbi Linn. (Julianto et al., 2017), essential oils from M. alternifolia (Dore et al., 2019) and leaf extracts of babadotan or Ageratum conyzoides (Mahpudin et al., 2017). The solution can be used for teat dipping both before and after milking with varying degrees of success. This paper aims to provide a brief review of the benefits of teat dipping as a method to manage and control the incidence of mastitis in dairy cows.

Results and Discussion

Milking Management

The occurrence of mastitis is generally caused by the interaction of various factors related to the host, pathogenic agents, and the environment (Pankey, 1989; Klaas and Zadoks, 2018). All of these factors are related to overall farm management (Sharif et al., 2009). Milking management according to Surjowardojo (2011) is divided into three stages, namely the preparation, implementation, and final stages of milking. The milking preparation stage includes activities to provide facilities for milking, cleaning cages, bathing cows, washing
udders, and removing the first 3-4 squirts (Munksgaard et al., 2001; Rushen et al., 2001; Widaningrum et al., 2006). The implementation stage is the milking process while the last stage is washing udder and doing teat dipping after milking (Surjowardojo et al., 2008; Mahardika et al., 2016). Elmoslemany et al. (2009) added that the total number of plate counts (TPC) in milk is a parameter that can describe the milk sanitary conditions starting from animal hygiene, milking process, sanitation of shelter environment, and handling after milking. According to FAO (2004) to obtain safe milk from a dairy farm, five basic requirements need to be considered namely animal health, hygienic milking, animal feed, animal welfare, and livestock environment. According to Lakew et al. (2009), the prevalence of mastitis is higher in cows with a low milking hygiene process when compared with a high level of hygiene.

Routine hygiene procedures of milking such as washing udder using a disinfectant, using a separate towel, flushing the milking machine and teat dipping are effectively decreasing mastitis (Erskine and Eberhardt, 1991). On the contrary, according to Harmon and Langlois (1986), if the procedure of implementing teat dipping was stopped, the incidence of mastitis had increased. According to Galton et al. (1982), the number of bacteria in the nipple to form a colony is affected by the nipple treatment procedure before milking. Nipple cleaning procedures using a wet towel and followed by a paper towel have significantly reduced the number of bacteria on the nipples (McKinnon et al., 1990; Gibson et al., 2008). Barkema et al. (1998) and Kelly et al. (2009) reported that washing with a towel before teat dipping was one of the important factors related to the low number of Somatic Cell Count (SCC). Supar and Ariyanti (2008) added that the transmission process of mastitis-causing agents can occur during milking manually through milking hands, water used to clean udders, cloths, or other equipment used during milking. The statement was strengthened by Van Den Berg (1988) who stated that transmission of mastitis can occur due to bacterial contact from the milker hands with the cows. The risk of contamination of microorganisms from milker hands is higher when compared to milking machines. Moreover, the dirty hands of the milker can make contamination of the skin of the nipples and milk then spread between cows in herds (Pandey and Voskuil, 2011). The udder needs to be washed before milking or rinsed using a towel to clean it so that it can stimulate milk release (Reinemann et al., 2008; Zalizar et al., 2018). Mahardika et al (2016) research results show that washing udder using a water temperature of 37°C significantly increases milk production compared to without washing or washing with a water temperature of 19-22°C.

The research showed that 96.3% of the dairy farmers in Jimma and 77% of Wolayta Sodo, Ethiopia had used hygienic
milking methods such as washing hands, milk tank, and udder before milking (Wolde and Jimma 2014; Duguma and Janssens, 2015). Nevertheless, Koster et al. (2006) and Sadeghi-Sefidmazgi and Rayatdoost-Baghal (2014) cautioned that washing udder with water will increase milk SCC rates. It caused by the flow of water from udder falling to the tip of the nipple will carry bacteria which results in an increased risk of mastitis. The results of these research studies indicate that milking management in accordance with recommended procedures can repress and reduce the risk of clinical and subclinical mastitis in dairy cows in the field.

**Benefits of Teat Dipping to Control Mastitis**

One of the activities after milking that can reduce the incidence of mastitis is teat dipping (Hogan and Smith, 1987; Zucali et al., 2011; Putri et al., 2015). According to Contreras et al. (2003) and Kamal and Bayoumi (2015), the teat dipping process is divided into 2, namely before milking and after milking. Teat dipping before milking is aimed at reducing microbial populations and minimizing new intramammary infections (Gleeson et al., 2018). Teat dipping after milking is primarily given to infected groups and has been shown to be very effective in preventing the spread of mastitis (Galton, 2004). However, the results of other studies show that not all pathogens that cause mastitis respond equally to the treatment of teat dipping (Osteras et al., 2008).

González and Wilson (2003), Osteras et al. (2008) and Hogan and Smith (2012) stated that various bacteria cause mastitis and in general they can be classified as infectious pathogens that have a good response to the treatment of teat dipping such as *Staphylococcus aureus*, *Streptococcus agalactiae*, and *Mycoplasma spp*. Whereas environmental pathogens are not responding to teat dipping treatment for example are *Streptococcus uberis*, *Streptococcus dysgalactiae*, *Escherichia coli*, and *Klebsiella sp*. Hamadani et al. (2013) added that although *C. bovis* is a common cause of mild clinical mastitis, it can spread among cattle in herds quickly if it is not treated by teat dipping after the milking process. Therefore, the prevalence of clinical mastitis caused by *C. bovis* tends to be low in cattle farms that routinely carry out teat dipping. Teat dipping has also been shown to have succeeded in reducing microbial populations and minimizing new intra-mammary infections, so teat dipping has been used widely, especially in flocks that are very susceptible to infection and is a very effective method for preventing mastitis (Paape et al., 2001; Bergonier and Berthelot, 2003; Contreras et al., 2003).

The benefits of teat dipping have been proven by a number of research results in the field which show that teat dipping can prevent and reduce the incidence of mastitis. Galton (2004) tested
mastitis in 120 Holstein cattle by applying *Streptococcus agalactiae* and *Staphylococcus aureus* to the nipples and 148 Holstein cows with *Streptococcus uberis* in a 22-week study. Cattle are grouped in 4 treatments, namely groups without teat dipping, manual teat dipping groups with commercial iodophors, manual teat dipping groups with iodophor formulas from teat dipping machines, and groups using teat dipping machines that release iodophors automatically. All teat dipping procedures are performed after milking. A bacterial suspension is applied to the nipples of all cows after milking preparations and just before the milking machine is attached. The results of the study showed that the teat dipping treatment using an automatic milking machine was able to reduce the number of bacteria *Staph. aureus* (88.2%), *Strep. Agalactiae* (94.4%) and *Strep. uberis* (93.8%). These results indicate that the milking machine that contains iodophors can reduce the number of various bacteria used in research. However, it should be remembered that this method can only be done in the dairy farming industry with a large capital scale because it requires more advanced technology. The results of a study by Kamal and Bayoumi (2015) in a dairy cow group with subclinical mastitis showed that the teat dipping group before and after milking had a lower Californian Mastitis Test (CMT) (+ and ++) score compared to the group without the teat dipping (++++) score. The results of field research by Zalizar et al. (2018) in the District of Pujon Malang Regency in lactation dairy cows showed that the number of cases of subclinical mastitis occurred less in cows that received teat treatment dipping with antiseptics when compared to the treatment of nipple rinse with water. The number of cows suffering from mastitis both subclinical and clinical and received teat treatment dipping after milking with antiseptic as many as 28 cattle, while the cases of mastitis that were treated were rinsed with water as many as 109 cows. Sanitary procedures such as cleaning dirt and organic material from the udder and nipple skin followed by the teat dipping process are not only able to prevent cases of mastitis but can also help reduce the number of bacteria that might get into the milk.

Teat dipping before milking gives many positive results because it has been proven to reduce the number of bacteria in the nipples (Dufour et al., 2011). Oliver et al. (2001) in his research suggested that teat dipping before milking combined with good milking preparation and ended with teat dipping after milking can reduce the incidence of new mastitis during the lactation period. Pankey et al. (1987) in his research concluded that teat dipping treatment before milking was able to reduce the incidence of mastitis by 54%. Gibson et al. (2008) suggested the benefits of teat dipping before milking can reduce or clean the bacteria on the nipples thus reduce the
potential for contamination in milk and also play a role in controlling the incidence of mastitis. Results of research by Mišeikienė et al. (2015) also showed that the use of antiseptics for teat dipping before milking was able to reduce the population of microbial *Escherichia coli*, *Staphylococcus coagulase-negative* and *Streptococcus uberis* on the nipples even though they did not have an impact on *Candida* sp.

However, there are also many opinions which state that teat treatment dipping before milking has little or no benefit in preventing mastitis. The treatment of teat dipping before milking in herded dairy cows showed insignificant results for eliminating *Strep. uberis* found in the nipples (Morton et al., 2014). Research by Gleeson et al (2018) also shows that teat dipping before milking does not have a significant impact on decreasing SCC or decreasing the incidence of new intramammary infections. According to (Dufour et al., 2011), SCC rates are more influenced by milking procedures such as wearing gloves during milking, teat dipping after milking, and routine checks on milking equipment compared to teat dipping before milking. This was confirmed by Nakano et al. (1995) which states that sanitation such as the cleanliness of the nipples and udder, the type of towel dryer, the type of antiseptic used, and the length of antiseptic contact with the nipples play a greater role in milking hygiene. Galton et al. (1982) add the statement that milking preparation can affect the number of milk bacteria and will ultimately have an impact on the quality of milk produced.

Differences opinion from the researchers must be examined carefully and more deeply before choosing by using a teat dipping solution that is considered close to ideal. Apart from these differences, some things must be considered: the fact that some teat dipping solutions can irritate, cause cracks and lesions on the nipple skin after the dipping process. Source of irritation from dipping solution in the form of the chemical composition of germicide, pH value that is too low or too high, storage of products that are not according to the rules, exposed to extreme temperatures, and dilution with inappropriate water sources. In addition to these weaknesses, the impact of the teat dipping treatment that must look at is the presence of teat dipping residue in milk. Research results between 2007 and 2008 in Canada showed that milk in storage tanks containing Iodine 54 to 1,902 μg / kg (Borucki et al., 2010). Besides originating from the feed, the high content of iodine in milk is thought to be carried from the implementation of teat dipping. Borucki et al. (2012) added that although survey results show that feeding and the implementation of teat dipping are the main contributors to the concentration of iodine in milk, controlled studies are still needed to determine exactly the contribution of both feed and teat dipping. Although there are still many pros and cons results of research and opinions
of experts and practitioners about the benefits of the treatment of teat dipping before milking, however, the treatment of teat dipping both before and after milking is proven to be very useful and is the most rational choice to be made in prevention programs and control of the incidence of mastitis, both subclinical and clinical.

**Various Types of Solutions of Teat Dipping and Their Benefits**

The idea of preventing mastitis through hygienic milking procedures has long been put forward in the dairy industry. The idea arose because of the awareness that mastitis cases could never be completely eliminated from livestock groups, but the cases could be suppressed as low as possible. The main keys in controlling the incidence of mastitis include using trained employees, teat dipping before and after milking, treatment of mastitis during the non-lactation period, and culling cows with chronic mastitis (Petrovski et al., 2006; Nielsen and Emanuelson, 2013).

Teat dipping is one of the keys to mastitis control in the dairy farming industry. Various methods and uses of teat dipping solutions have been widely used and utilized for this purpose. Solutions that can be used for teat dipping purposes include iodine (Poutrel et al., 1990; Flachowsky et al., 2007), potassium permanganate (Yasothai, 2017), calcium hypochlorite (Putri et al., 2015), chlorhexidine (Goodwin et al., 1996), chlorhexidine gluconate (Hogan, et al., 1995), chlorine (Drechsler et al., 1990), iodophor (Dunsmore et al., 1977), sodium hypochlorite (Pankey et al., 1983; Boddie et al., 1998), Sodium chloride and lactic acid (Oliver et al., 1989), phenolics (Oliver et al., 2001), Dodecyl Benzene Sulfonic Acid (DDBSA) (Fisher and Newbould, 1983), quaternary ammonium (Stewart) and Philpot, 1982), bronopol (Boddie and Nickerson, 2002) and hydrogen peroxide (Leslie et al., 2006). Although various types of disinfectants can reduce the incidence of mastitis, but have raised concerns about the formation of residues in milk due to the high concentration used (Galton et al., 1986).

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<th>Animals</th>
<th>Types of teat dipping solutions</th>
<th>Ability</th>
<th>References</th>
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<tbody>
<tr>
<td>Friesian Holstein cows</td>
<td>1% iodine</td>
<td>Safe to use and has no impact on the quality of milk</td>
<td>Castro et al., 2012</td>
</tr>
<tr>
<td>Friesian Holstein cows</td>
<td>Iodine, Chlorhexidine, Chlorine</td>
<td>Significant reduction in the number of Staphylococcus sp. and Streptococcus sp. on the nipple surface</td>
<td>Gleeson et al., 2009</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>1.6% phenol</td>
<td>Reducing cases of intramammary infection and the incidence of new mastitis</td>
<td>Peters et al., 2000</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>1% potassium permanganate</td>
<td>No significant effect for mastitis control</td>
<td>Abinaya and Thangarasu, 2017</td>
</tr>
<tr>
<td>Cows and buffalos</td>
<td>2% iodine</td>
<td>Decreased number of SCC</td>
<td>Shailja and Singh, 2002</td>
</tr>
</tbody>
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Table 1. illustrates the various solutions used for teat dipping and their ability to reduce the incidence of mastitis through decreasing SCC and decreasing numbers of various types of bacteria that cause mastitis. The many types of teat dipping solutions on the market are differed by its strengths or weaknesses in its ability to protect the nipples. The advantage of a product given significant effect is the level of its ability to protect a large number of bacteria that cause mastitis (Ebehart et al., 1983; Schmidt et al., 1985; Oliver et al., 1990). Although the effective teat dipping treatment can reduce the level of intramammary infections caused by *Streptococcus agalactiae* and *Staphylococcus aureus* (Bramley and Dodd, 1984), according to Oliver and Mitchell (1984) and Smith et al. (1985) it has not been effective enough in controlling mastitis caused by pathogenic environments such as coliforms and streptococci except *Strep. agalactiae*.

Today, teat dipping solutions are widely marketed with highly variable formula compositions and can be used single or in combination with other solutions such as iodine with collagen protein emollient (Boddie and Nickerson, 1989), Sodium chloride and lactic acid (Poutrel et al., 1990) and Iodophor with DDBSA (Pankey et al., 1987). The most commonly used solution teat dipping today is iodine in various concentrations. According to Boddie et al. (2000) and Leslie et al. (2005) iodine have long been used extensively as a teat dipping active ingredient with concentrations ranging from 0.10% to 1.0%. Iodine is a broad-spectrum germicide and is considered effective against all bacteria, fungi, viruses, and bacterial spores that cause mastitis (Philpot et al., 1978). As a teat dipping, Iodine has been formulated with a low pH for a long time to obtain a

<table>
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<th>Solution</th>
<th>Percentage</th>
<th>Effect</th>
<th>Reference</th>
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<tr>
<td>Dairy cows</td>
<td>0.5% iodine</td>
<td>Decreased number of SCC, decreased <em>Staphylococcus aureus</em> and <em>Streptococcus agalactiae</em></td>
<td>Kamal and Bayoumi, 2015</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>1% povidone-iodine and glycerin 10%</td>
<td>Significant decrease in <em>Staphylococcus aureus</em>, <em>Escherichia coli</em>, although <em>Streptococcus agalactiae</em> did not experience a noticeable decrease</td>
<td>Pisestyani et al., 2017</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>2% iodine</td>
<td>Prolongs milk reductase time and decreases SCC rate</td>
<td>Mahardika et al., 2016</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>0.25% iodine</td>
<td>Very effective against pathogens that cause infectious mastitis but ineffective against pathogens derived from the environment.</td>
<td>Oliver et al., 1991</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>1.94% <em>dodecylbenzene sulfonic acid</em> (DDBSA)</td>
<td>Significantly decreased the incidence of intramammary infections due to <em>Staphylococcus aureus</em> and <em>Streptococcus agalactiae</em> although not significantly</td>
<td>Pankey et al., 1984</td>
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Table 1.
stable iodine concentration. The concentration of iodine that is widely used as a teat dipping is 0.05% (Pankey et al., 1983), 0.1% (Boddie and Nickerson, 1990), 0.175% (Boddie et al., 1989), 0.25% (Oliver et al., 1991), 0.5% (Nickerson et al., 1986) and 1.0% (Eberhart et al., 1983). Although the price is quite cheap and easy to obtain, the use of iodine can be a residue in milk. A significant increase in residue has been found when iodine 1% is used as a teat dipping. According to Boddie and Nickerson (1989) iodine residues increase in milk by 80 to 100 µg / L when 1% iodophor is used as a teat dipping. Different results were shown in the study of Vavrova et al. (2014) which states that a concentration of 3% iodine is the most effective choice for teat dipping when compared with concentrations of 0.4% and 1.5%. Unfortunately, iodine residue examination in milk in the study was not carried out. According to Nickerson (2001), another lack of iodine is that it can irritate the nipple skin, although this is denied by Foret et al. (2003) which states that the use of iodine as a teat dipping does not irritate the nipple.

Another teat dipping solution that is widely circulating in the market is chlorhexidine. Chlorhexidine is a colorless solid organic compound, it is soluble in water and usually comes in 2 forms, namely chlorhexidine gluconate and chlorhexidine acetate (King et al., 1977). The advantage of using chlorhexidine is that it is not irritating and has a residual effect which means it can kill microbes for a long time. However, the disadvantage of chlorhexidine is that it is more expensive compared to iodine. Schultze and Smith (1970) challenged the evaluation of the ability of chlorhexidine as a teat dipping in reducing the level of \textit{S. aureus} infection in the udder. After being challenged with an artificial infection with \textit{S. aureus} for 31 weeks, the results of his study showed that 9 udders without the treatment of teat dipping had infections and only 3 udders with the treatment of teat dipping had infections.

Barnum et al. (1982) conducted a study using DDBSA as a teat dipping solution in dairy cows. The results showed that the infection rate of \textit{Streptococcus agalactiae} was 62.5% and \textit{Staphylococcus aureus} was 75% without dipping with DDBSA. Whereas dipping treatment with DDBSA showed a much lower infection rate of 12.5% for \textit{Streptococcus agalactiae} and 21.5% for \textit{Staphylococcus aureus}. The teat dipping solution containing DDBSA works by denaturing proteins, deactivating the essential enzyme system, and disrupting microbial cell membranes. Dodecylbenzene sulfonic acid is also effective against Gram-positive and Gram-negative bacteria and yeast (Oura et al., 2002).

Currently, it has been tested and tried out in the field of alternative antiseptics for teat dipping from natural ingredients. Research using the leaves of the cherry leaf (\textit{Muntingia calabura L.}) as a teat dipping has been done by Kurniawan et al. (2013). The
results of his study showed that the palm leaf decoction (*Muntingia calabura* L) with a concentration of 20% was able to reduce the incidence of mastitis by up to 80%. Purwantiningsih et al. (2017) in his research using noni (*Morinda citrifolia*) fruit extracts on the results of the CMT test. Noni (*Morinda citrifolia*) has been known to have antibacterial properties because it contains antibacterial substances such as acubin, L. asperuloside, alizarin, and some anthraquinone substances. The results of his research showed that noni fruit extract can inhibit the growth and spread of bacteria that cause mastitis thereby reducing the risk of mastitis. Vala et al. (2013) and Ramprabhu et al. (2014) evaluated the ability of herbal Mastidip liquid (M / S Ayurvet Limited, India) containing herbal viz, *Berberis lycium, Curcuma longa, Eucalyptus globulus* and other ingredients with certain concentrations as teat dipping to reduce the incidence of mastitis. The trial results show that the application of teat dipping using Mastidip liquid can maintain the health of healthy udder animals, reduce the number of SCC, and reduce the incidence of mastitis. According to Waghmare et al. (2013), Mastidip Liquid may work by creating a barrier at the tip of the nipple thereby reducing the chance of the infectious agent entering it. Mastidip Liquid may also play a role in helping reduce the microbial population of the nipple skin after milking. With alternative antiseptic studies made from easily available local materials, it is hoped that it will reduce the cost of controlling mastitis cases, especially on small-scale smallholder farms in poor and developing countries. However, further research is still needed to optimize the ability of alternative antiseptic ingredients.

**Conclusion**

Until now, teat dipping, both before and after milking is one of the most important keys in mastitis prevention and control. various teat dipping solutions are widely available in the market both from chemicals and natural ingredients, although further testing is still needed to find out the effectiveness of each teat dipping solution. Since it is a very important factor in the management of a dairy farming business, every dairy cattle business should run a teat dipping procedure to improve the quality of milk produced.

**References**


https://doi.org/10.3168/jds.S0022-0302(89)79238-9


Nasional Prospek Industri Sapi Perah Menuju Perdagangan Bebas 2020; 2008 Apr 21; Jakarta,


Wolde. S., and A. Jimma. 2014. Assessment of knowledge gap and constraints affecting production and consumption of standardized dairy products in Wolayta Soddo,

