

Research Article

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Use and efficacy of homeopathy in prevention and treatment of bovine mastitis

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Abstract: Bovine mastitis is an important disease in dairy farming. As alternative therapy to antibiotics, whose use is seen as increasingly critical, farmer try to treat mastitis with homeopathy, for example. The present study examined i) whether homeopathic treatments for bovine mastitis can have positive treatment outcomes, ii) which treatments have been successful and under which conditions, iii) indications for future studies and applications for homeopathy to treat mastitis. 32 studies published to date have been evaluated. Assessment criteria and a rating score of 0 to 5 points were fixed for the appraisal. Healing and prophylaxis of mastitis were the primary focus to highlight the medication success and its framework for suitable mastitis therapy. The top eight studies of this quality ranking were subjected to differentiated evaluation. The selected studies showed a positive treatment outcome of homeopathy. Due to the homeopathic effect and the most used remedies in the selected studies, the medication should be chosen according to the homeopathic drug picture. With homeopathic drugs it was possible to reduce the antibiotic use by up to 75%. Some studies indicated that homeopathy might have a positive long-term effect. Furthermore, the results suggested a high self-healing ability in bovine mastitis.

Keywords: homeopathy, dairy cow, complementary veterinary medicine, antibiotics, clinical trials

1 Introduction

Bovine mastitis is a common disease in dairy farming, which represents an economic, ecological and health problem (Kruif et al. 2007). Mastitis is an inflammation of the udder, which is divided into a subclinical and a clinical form. Subclinical mastitis is characterized by an increased content of somatic cells (>100,000 cells/ml) and/or pathogens in the milk. It is usually treated at the end of lactation with a combination of (long-term) antibiotics and internal teat sealer (antibiotic drying off) (DVG 2012; Wolter 2015; Molina et al. 2017). Clinical mastitis means the presence of local and general symptoms together with an increased cell count and pathogens in the milk (Winter 2009; DVG 2012). Depending on the severity of disease, clinical mastitis is treated by antibiotics either local or systemic (Hamann 2003; Tenhagen 2013). The antibiotic use is seen as increasingly critical because of the rising bacterial resistance (Wallmann 2016; Schulz-Stübner 2016). In organic and biodynamic farming, the use of antibiotics is restricted by legal requirements; therefore, the use of complementary medicine, for example homeopathy is supported (European Union 2008). Because of this, homeopathy is mainly used by ecological and biodynamic farmers in animal husbandry (León et al. 2006; Gordon et al. 2012).

Homeopathy is based on three principles: the similia principle, drug testing with healthy humans and dilution of doses, which were developed by the German doctor Samuel Hahnemann. According to Hahnemann's observations during drug testing, the simile is able to initiate a healing, which causes symptoms in the examination of healthy people, which are as similar as possible to the symptoms of the patient (*Similia similibus curentur*) (Braun 1995). Homeopathic remedies are potentiated drugs of components of plants or minerals for example, which effects are tested in drug trials on healthy people. These results are transferred to veterinary medicine, because there are rarely any homeopathic drug tests on animals (Ekert 2013). The preparation of homeopathic remedies consists of dilution and shaking or trituration of the active substance with a carrier

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substance. According to homeopathic understanding, the healing power contained in the drug are released through mechanical processing and strengthened with each potentiation step. According to homeopaths, non-material potencies above dilution D23 (Avogadro's number) act by passing on the energetic information with the help of the carrier substance (Braun 1995; Steingasser 2016).

Due to these characteristics of homeopathy, the effectiveness of this complementary medical method is a contentious issue in science. Homeopathy is criticised to be a placebo effect (Shang et al. 2005). Linde et al. (1997) and Ammon and Kösters (2016) claim that homeopathy has an effect better than placebo. However, up to now research studies demonstrate inconsistent results. An analysis of peer-reviewed publications shows a homeopathic effect in dairy cattle in nine studies compared to ten trials without an effect (Doehring and Sundrum 2016). The authors of several meta-analyses criticize the partly low and very heterogeneous quality of the trials so that a generalizable conclusion is not possible (Mathie et al. 2012; Mathie and Clausen 2014; Mathie and Clausen 2015a; Mathie and Clausen 2015b; Francoz et al. 2017). According to Klocke and Fidelak (2010), the combination of herd health management and environmental improvement measures with the use of homeopathic remedies might be a successful strategy to reduce the use of antibiotics.

The following research questions should be answered in this study: Has homeopathy an effect in prevention and treatment of bovine mastitis? If it has a better effect than standard medication or placebo, which homeopathic remedy can be recommended for bovine mastitis? Are there indications for future studies and applications for homeopathy to treat mastitis?

2 Methods

To answer the research questions, homeopathic studies published to date (February, 2018) were collected by literature and database searching of the online-library of the Carstens Foundation, published meta-analyses (Mathie et al. 2012; Mathie and Clausen 2014; Mathie and Clausen 2015a; Mathie and Clausen 2015b; Doehring and Sundrum 2016; Francoz et al. 2017), references of doctoral theses about the topic of mastitis and homeopathy (Fidelak 2003; Garbe 2003; Schlecht 2004; Röhrs 2005; Walkenhorst 2006; Werner 2006; Notz 2011; Ebert 2016) and online databases (NLM pubmed.de, orprints.de, researchgate.com).

All studies were considered, regardless of their year of publication and internal validity (control group, blinding,

randomization). In order to get the most comprehensive picture, the evaluation included peer-reviewed studies, as well as non-peer-reviewed studies from publications, conference papers, journals, pilot and practical studies of preventive and therapeutic concepts of organic and conventional livestock husbandry.

67 studies in English and German language from 1982 till 2016 were identified.

Studies which were inaccessible to the author due to inadequate source information, limited time slot and lack of procurement possibilities were not considered. Duplicates and studies with less information about the trial design or the homeopathic remedy were excluded, as well as case studies on individual animals.

After applying the inclusion and exclusion criteria, 32 studies could be used for evaluation. Assessment criteria and a rating score of 0 to 5 points were fixed for the appraisal (Table 1 and 2). The chosen criteria based on scientific guidelines for medical research (EMA 2000; Hektoen 2002; Wein 2002; Arlt and Heuwieser 2011) and the information given in the studies. General information of the studies, the formal presentation of the results (statistics, completeness) and internal validity were recorded in Table 1.

Healing and prophylaxis of mastitis were the focus to highlight the medication success and its framework for suitable mastitis therapy. Due to this, the effect of homeopathy was evaluated by several criteria (Table 2). The success of healing and prevention were presented in opposite ways by the proportion of cured animals or number of incidences. For this reason, the assessment criteria were divided (Table 2) into the self-healing ability, the healing ratio of the trial groups and their percentage difference to each other and the cure rate in the homeopathic group for the treatment success. The success of prevention was described by the mastitis rate and the mastitis ratio of the test groups and their percentage difference to each other. The rating score was given concerned to complete information and relevance for homeopathy and scientific research. For example, 5 points were given for complete information of the dosage which contained the period, the repetition, the used amount and the mode of application of the drug.

When comparing the studies, the very heterogeneous qualitative and quantitative presentation of results made the evaluation difficult and did not provide a consistent definition of healing. Therefore, the highest results of the treatment studies of one of the three levels of clinical, bacteriological or complete cure were evaluated. This applies to the four criteria 'self-healing of placebo or untreated group', 'relation of cure (RC)', 'difference RC:

Table 1: Assessment criteria with a rating score of 0 to 5 points: general information of the studies

Criteria	5 points	3 points	1 point	0 points
Number of animals	> 139	79 - 139	< 79	No information
Definition of inclusion/ exclusion criteria	Inclusion and exclusion criteria	Inclusion criteria	Exclusion criteria	No information
Investigation period	>6 month	>3 – 6 month	Up to 3 months/ 12 weeks/ 90 days	No/imprecise information
Homeopathy	Remedy and potency	Only remedy	Only potency	No information
Dosage	Complete information	2 or 3 informations	1 information	No information
Comprehensible drug selection		Complete declaration (reference to symptoms)	Partly (no reference to symptoms)	No information
Criteria of success	1 point per criteria (e.g. cell count, bacteriology, California-Mastitis-Test)			No information
Definition of cure	1 point per defined kind of healing (e.g. clinical cure, bacteriological cure) or defined success of prevention; max. 5 points			No definition, no information
Result presentation	Complete statistical	Numerical value	Indication of results without data	No information
Information of treatment success	Complete in all groups	In at least 1 group	Wording without data	No information
Control group	Untreated	Placebo	Antibiotics or Internal Teat sealer	No controlgroup
Blinding	Triple	Twice	Single	No blinding
Randomisation			Yes (kind of randomisation: +1 point)	No randomisation

Table 2: Assessment criteria with a rating score of 0 to 5 points: effect of healing and prevention

Criteria	5 points	3 points	1 point	0 points
<i>Treatment study</i>				
Self-healing of placebo or untreated group	> 30%	16 – 30%	1 – 15%	No information
Relation of cure (RC)	Homeopathy > Antibiotics	Homeopathy > Placebo	Homeopathy < Antibiotics	Homeopathy < Placebo or no control group
	2 points: Homeopathy = control group (antibiotics or placebo)			
Difference RC: homeopathy versus placebo or versus antibiotics	> 30%	16 – 30%	1 – 15%	< 0 or no information
Cure rate of homeopathy	> 60%	31 – 60%	1 – 30%	No cure
<i>Prevention study</i>				
Mastitis rate of placebo or untreated group	0 – 15%	16 – 30%	> 30%	No information
Relation mastitis rate (MR)	Homeopathy < Internal Teat sealer	Homeopathy < Placebo	Homeopathy > Internal Teat sealer	Homeopathy > Placebo
Difference MR: homeopathy vs. placebo or vs. Internal Teat sealer	> 30%	16 – 30 %	1 – 15%	< 0 or no information
Mastitis rate of homeopathy	0 – 15%	16 – 30%	> 30%	No information

homeopathy versus placebo or versus antibiotics' and 'cure rate of homeopathy' of the treatment studies.

The top eight studies of the quality ranking of Table 2 with a mean value ≥ 2.5 were subjected to differentiated evaluation in detail with a focus on cure and prevention of mastitis (Day 1986; Searcy et al. 1995; Merck 2004; Varshney and Naresh 2005; Werner 2006; Klocke et al. 2007; Klocke et al. 2010; Ebert 2016) (Table 3 and 4). If several studies had the same mean value, the higher mean value of all assessment criteria (Table 1 and 2) was decisive. Despite a low mean value, the study of Otto (1982) was used as a further reference for comparison because of its very good homeopathic cure rate of more than 80%. Since the evaluation contained only one study with an antibiotic trial group, three further studies (Garbe 2003; Hektoen et al. 2004; Mueller 2004) were selected in order to better compare the effect of antibiotic and homeopathic therapy (Table 3 and 4).

Ethical approval: The conducted research is not related to either human or animal use.

3 Results

3.1 Treatment studies

The cure of mastitis is separated into four stages to evaluate the healing process (Table 4). Clinical cure means that there are no signs of illness left and the milk has a normal appearance. Cytological cure means that there are no signs of illness and the milk contains less than 100,000 cells/ml milk; a higher number of cells is a sign of inflammation. Bacteriological cure means that there are no signs of illness and no pathogens in the milk. The complete cure combines the three previous levels of cure (Merck 2004). The trial results based on 503 cows in the homeopathic, 325 cows in the antibiotic, 260 cows in the placebo and 40 cows in the untreated trial group. The average time to control homeopathic effect was 24 days. Over all levels of cure, homeopathy reached an efficiency of 43% and the antibiotic therapy was almost 10% more successful. One third of all affected udder quarters were cured by placebo or without any medication.

3.2 Subclinical mastitis

With homeopathic therapy a moderate cure rate between 12 and 67% (mean value 28%) was achieved in two studies of subclinical mastitis (Table 4, Figure 1). The

Table 3: Mean value of selected studies after applying the assessment criteria

Author	Mean value table 2	Mean value table 1 and 2
Klocke <i>et al.</i> (2010)	4.00	3.41
Searcy <i>et al.</i> (1995)	4.00	2.59
Ebert (2016)	3.50	3.88
Day (1986)	3.50	2.53
Varshney and Naresh (2005)	3.18	3.25
Werner (2006)	3.00	3.47
Klocke <i>et al.</i> (2007)	3.00	3.18
Merck (2004)	2.50	3.29
Hektoen <i>et al.</i> (2004)	2.50	2.82
Garbe (2003)	1.50	3.18
Mueller (2004)	1.50	2.59
Otto (1982)	1.25	2.65

used nosode, a special homeopathic remedy which consists of inactivated causal agents, was less efficient than classical homeopathic remedies. During the eight-week investigation period, an increase of healing rates was recognizable in the homeopathic and the untreated trial groups (Klocke et al. 2007). The trial results of Searcy et al. (1995) showed significant differences between homeopathy and placebo. Referring to the small number of animals and a study period of only four weeks, the results were interpreted cautiously positive by the authors. Overall, there was below average success compared to trial results of clinical mastitis.

3.3 Clinical mastitis

Homeopathic healing success varied between 14% and 87% (average 45%), antibiotics achieved an efficiency of 0-83% (average 53%), both depending on the type of cure and the examination date (Table 4, Figure 2). The combined therapy of homeopathy and antibiotics reached a cure rate up to 99.5%. Animals of the placebo groups showed high (self-) healing rates up to 68%. Over a longer investigation period, almost all studies showed increasing cure rates in the homeopathic group and the placebo and untreated control groups. There were similar cure rates of all different trial groups in clinical and cytological cure. In bacteriological cure, antibiotics were almost 30% more efficient than homeopathy. This might depend on the different temporal and substantial mode of action and made a direct comparison more difficult.

Table 4: Cure rates of udder quarters (%)

Type of cure	Clinical cure				Cytological cure		Bacteriological cure				Complete cure				Examination date after end of medication
Trial group	Hom	Ab	Pl	U	Hom	Pl	Hom	Ab	Pl	U	Hom	Ab	Pl	U	
Studies of subclinical mastitis															
Searcy <i>et al.</i> (1995)					67 ^a	29 ^b									Day 30
Klocke <i>et al.</i> (2007)							Hom 35 Nos 27		Hom 16 Nos 42 ^a	17 ^b	Hom 12 Nos 12		Hom 3 Nos 31 ^a	4 ^b	Day 28
							Hom 41 Nos 24		Hom 19 Nos 31	25	Hom 24 Nos 12		Hom 6 Nos 19	17	Day 56
Studies of clinical mastitis															
Otto (1982)											78,5 87 (99,5)				Day 5 Day 10
Garbe (2003)	51	60					42	56			21	38			Day 14-21
Hektoen <i>et al.</i> (2004)	47	45	56				29	35	13		19	20	6		Day 28
Merck (2004)	74 (95)		68		23	19	40		24		15 ^a		2 ^b		Day 0
	64		58		43	41	40		26		28 ^a		11 ^b		Day 35
	54		50		41	47	40		26		32 ^a		13 ^b		Day 56
Mueller (2004)	48	68					50	75							Day 7
	56	69					65	74							Day 14
Varshney and Naresh (2005)	86,6	59,2													Day 52
Werner (2006)							43,6 ^b	82,8 ^a	56,6 ^b		14 ^a	0 ^b	9		Day 7
							61,5	82,8	65,2		21	24	14		Day 14
							59	82,8	56,5		28	24	16		Day 28
							61,5	82,8	56,5		36 ^a	24	16 ^b		Day 56
Ebert (2016)	21,4 (75,7)		28 (76,1)	47 (80)											Day 7
	25 (88,6)		32 (87)	56 (93,3)											Day 14

Abbreviations: Hom: Homeopathy; Nos: Nosode; Ab: Antibiotics; Pl: Placebo; U: Untreated

Note: The values in brackets correspond to the cure rates of combined homeopathic and antibiotic therapy. Differences between the values per line and per cure marked by a different letter (a, b) are significant ($P < 0.05$).

The effect of homeopathy compared to placebo was better in all trials except for Ebert (2016). In complete cure the healing success of homeopathy and antibiotics were almost the same, in some cases homeopathy was better than antibiotics. Homeopathy compared to placebo was partly significant - more effective.

3.4 Prevention studies

Two preventive studies were evaluated (Day 1986; Klocke *et al.* 2010) (Data are not shown in detail). Day (1986) used a combined nosode of five pathogens. 25% of the placebo-controlled animals developed mastitis contrary to 2.5% of

the animals of the homeopathic group. The comparisons of the cell counts were made nine month before medication and nine month during homeopathic medication, but not between homeopathy and placebo. The homeopathic treated cows had a lower average somatic cell count per month of 160,000 cell counts/ml compared to the period before medication. This method of comparison made the validity of the study more difficult. Good and meaningful results could be achieved by a study of Klocke *et al.* (2010). Homeopathy was compared to internal teat sealer, which is normally used for cows at drying off. The proportion of normal secreting quarters with a cell count below 100,000 cells/ml of all involved quarters 100 days post calving was nearly equal in all trial groups (QSCC) (homeopathy 68%,

internal teat sealer 70%, untreated control group 65%) (Figure 3). Cows whose milk samples had a cell count below 200,000 cells/ml at drying off, had a significant mastitis protection in the homeopathic group 100 days post calving compared to cows of the untreated group and

a better but non-significant effect compared to internal teat sealer. The mastitis protection includes pathogen-free milk samples and a cell count below 200,000 cells/ml (CSCC) (homeopathy 91%, internal teat sealer 83%, untreated control group 81%) (Figure 3). The limit of

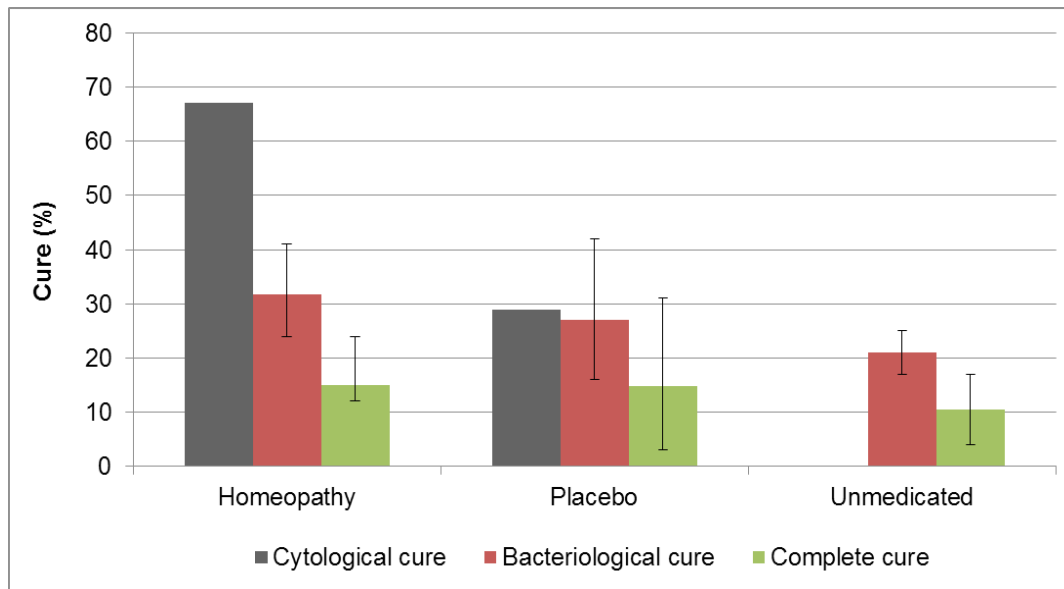


Figure 1: Cure of subclinical mastitis as percentage in three trial groups. The sample size of each test group was: Homeopathy: Searcy et al. (1995): 51 udder quarters (cytological cure); Klocke et al. (2007): 67 udder quarters (bacteriological cure, complete cure); Placebo: Searcy et al. (1995): 52 udder quarters (cytological cure); Klocke et al. (2007): 58 udder quarters (bacteriological cure, complete cure); Unmedicated: Klocke et al. (2007): 24 udder quarters (bacteriological cure, complete cure). Note: Due to less studies of subclinical mastitis, the bar of cytological cure represents the results of Searcy et al. (1995) not as mean values. The bacteriological and complete cures show the results (Klocke et al. 2007) as mean values with minimum and maximum values as lines, all in percentages. (Used data see table 4)

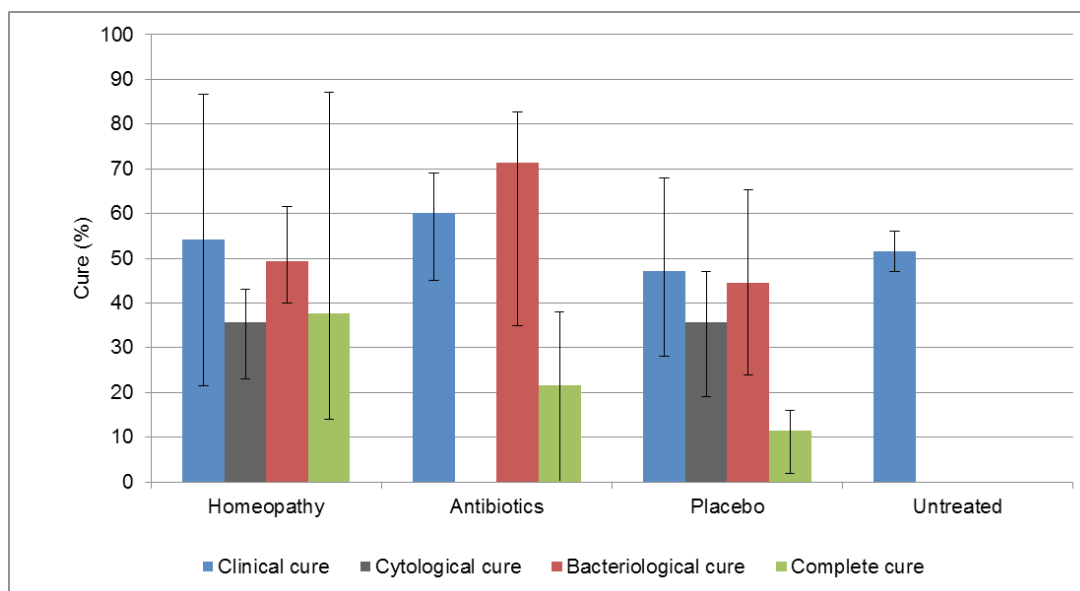


Figure 2: Cure of clinical mastitis as percentage mean value in four trial groups. Note: The bar chart of figure 2 shows the results of studies of clinical mastitis (data see Table 4) in percentages as mean values and the minimum and maximum values as lines. The results shown in the antibiotics group include the results of the three further studies mentioned above.

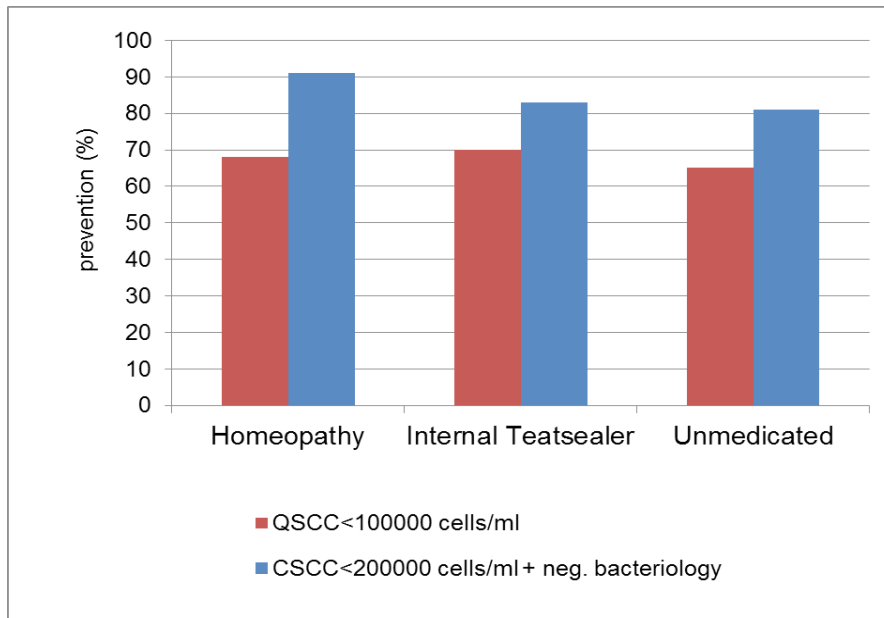


Figure 3: Prevention of mastitis in three trial groups compared between quarter somatic cell count (QSCC) and cow somatic cell count (CSCC) (Data from: Klocke et al. 2010).

200,000 cells/ml was used because of manufacturer recommendation that internal teat sealer should only be used up to this limit to minimize the risk of clinical mastitis during the dry period. 9% of the cows of the homeopathic group and 11% of the cows treated with internal teat sealer developed a clinical mastitis during the first 100 days post calving. The untreated group showed the lowest incidence for clinical mastitis with 3% (Klocke et al. 2010). According to homeopath, homeopathic remedies could reactivate former illnesses (Braun 1995). This might be an explanation that 9% of the cows of the homeopathic group developed a clinical mastitis. The results indicated that homeopathy might be an effective alternative to internal teat sealer.

4 Discussion and conclusion

The analysed studies have been selected because of their good healing results to find out under which conditions homeopathy can have an effect. After evaluating the scientific trials, it can be determined that the measure of cure depended on the selected homeopathic remedy, the pathogen, study conditions and individual conditions of the farm. Homeopathy has shown in some studies that it can have a better effect (partly significant) compared to placebo. The criticism of homeopathy as a placebo effect could be refuted by the results of these studies. The achieved efficiency of antibiotics in these trials largely coincides with the literature data on healing success

of clinical mastitis with a healing range of 14% to 96% (Garbe 2003; Werner 2006). For mastitis incidence the prophylactic effect of teat sealer as standard medication in the dry period is stated by 3.5% in literature (Krömker et al. 2014, cited in Kiesner et al. 2015) compared to 10.5% in an untreated control group. This is opposed to the results of Klocke et al. (2010) with a mastitis incidence of 11% by using internal teat sealer and 3% in the untreated control group. In literature the self-healing ability during lactation is stated by 30% and 50-70% for dry off cows (Dorenkamp 2010). Together with the results of the cows dried off untreated in the preventive study (Klocke et al. 2010), it could be questioned whether a therapeutic or preventive medication is always necessary.

In conclusion it can be said that an effect was recognizable in prophylactic and therapeutic application of homeopathy in the selected trials. Due to the evaluated trial results, the efficiency might be better in clinical than in subclinical mastitis. This might be explained by missing signs of illness of the cows in subclinical mastitis, which impedes the correct choice of the homeopathic remedy. No specific medication could be recommended for bovine mastitis. Most used remedies, in 8 of 9 selected studies, were Belladonna, Bryonia, Lachesis and Phytolacca. All these four remedies referred to mastitis through their homeopathic drug picture. Due to this, homeopathic remedies should be used according to indication and individual symptoms of the cow. This result supported the citation of Hahnemann: “In every case of illness,

choose a remedy which can cause a similar disease as it should heal!" (Hahnemann 1992). The comparison of the effect of homeopathic and antibiotic therapy was limited because of their different mode of action. In the combined use of homeopathy and antibiotics it was possible to reduce the antibiotic use by up to 75% (Merck 2004). This was achieved by using homeopathy or a combination of homeopathy and antibiotics if needed. The phenomena indicated that homeopathy might have a long-term effect, which could help to stabilize animal health. This was recognisable the longer the investigation period lasted on. Furthermore, the results suggested a high self-healing ability in bovine mastitis. A further need for research on the homeopathic effect, the application within the various types of bovine mastitis and their self-healing ability is emphasised. It is recommended to develop a study design that considers the specific characteristics of homeopathy. At last, due to the high rates of self-healing, it should be examined which types of mastitis have a high self-healing rate and which conditions are necessary for self-healing.

The results of the evaluation showed, that homeopathy might be an alternative possibility to treat bovine mastitis in organic and biodynamic agriculture depending on the type of mastitis. A therapy of mastitis with homeopathic remedies in combination with antibiotics if necessary, or homeopathy in prevention might be a possible application.

Conflict of interest: Authors declare no conflict of interest.

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