

## TROUBLE SHOOTING OFF-FLAVOR (BAD ODOR) AND BAD TASTE IN MILK

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Cows and buffaloes sometimes produce milk which has an off-flavor (i.e. bad odor or offensive odor) and a bad taste. Although, there are multiple causes of this problem, the bad odor/bad taste of milk in Pakistan/India seems to be generally associated with certain feeds and presence of some weeds in the fodders. Flavor producing substances present in the feed or weeds are absorbed from the digestive tract into the blood, enter the udder, and appear in milk. The milk carrying abnormal and bad odor is not liked by the consumers and in many cases such milk has to be discarded by the producers. The problem of off-flavor and bad taste in milk is worldwide. Specially trained milk flavor/taste evaluators are used in advanced countries to detect and categorize off-flavors and bad taste of milk. Milk is generally considered to have a flavor defect if it manifest an odor, a foretaste or an aftertaste, or does not leave the mouth in a clean, sweet, pleasant condition following tasting (Alvarez, 2009).

In Pakistan/India, the problem of bad odor in the milk is especially common in spring season and is generally associated with the presence of certain weeds in berseem. The problem is sporadic and affects only some animals in the herd. Not all herds face the problem. Boiling of milk with bad

odor may lead to the presence of bad odor in the kitchen. Tea prepared or curd made from such milk also carries bad odor and a bad taste. In some affected animals, it is a late lactation problem. Problem may persist for months. Sometimes, a bad odor is also detectable from the body and mouth of the affected animals. Addition of wheat straw to fodder generally reduces the severity of the problem. American Dairy Science Association (2005) categorizes the off-flavor of milk into 4 major (A-B-C-D) groupings: Absorbed ('barny', 'cowy', feed, garlic/onion), Bacterial (acid, bitters fruity/fermented, malty, rancid, unclean [i.e. psychrotrophic]), Chemical (astringent, cooked, lacks freshness, light oxidized, metal oxidized, rancid) and delinquency (flat, foreign, salty, unclean). A 'cowy' flavor defect denotes a distinct cow's breath-like odor and a persistent unpleasant, medicinal or chemical after taste. The difference between 'cowy', 'barny' and 'unclean' off-flavor is that of intensity of bad odor or taste (Alvarez, 2009).

**Keywords:** buffaloes, *Bubalus bubalis*, cows, milk, bad taste, off-flavor, Pakistan, India

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## **CAUSES AND TYPES OF MILK OFF-FLAVORS AND BAD TASTE IN MILK**

### **Weeds, odoriferous fodders and silages**

Many weeds, certain fodders and strong smelling silage are common causes of bad odor in milk. *Coronopus didymus* (= swine cress; known as *Pitpapra* in Hindi and *Jangli Halon* in Urdu) is a common weed in berseem incriminated for producing bad odor in milk of cows and buffaloes fed on late cuttings of berseem (Nayyar *et al.*, 2001). This weed contains an odoriferous compound known as benzylthiocyanate. Feeding of cabbage, turnips, ragweed, bitter weed, peppergrass, buckhorn and some other weeds, feeding of strong smelling silage (sweet clover, alfalfa or lucerne, corn and soybean), sugar beet tops etc. can also lead to bad odor in milk. The bad flavor of milk associated with some weeds can be controlled if the weeds are withheld from the lactating animals 5 h before milking.

### **Presence and multiplication of microorganisms in milk**

Milk is an excellent growth medium for microorganism. Serious taste and odor defect in milk can result from the multiplication of microorganisms in milk. The growth of microorganisms in milk leads to accumulation of metabolic products of microorganisms. Most of the microorganisms when growing in milk also produce a variety of different lipolytic and lactose destroying enzymes. Sour, bitter, fruity, rancid, malty taste of milk and a variety of bad odors are the consequence of growth of bacteria, yeasts and moulds in milk. Bad taste can be detected when germ concentration in milk exceeds  $10^6$  per ml of milk.

### **Absorption of bad odor from the strong smelling silage or odor from the barn**

The natural fat of milk and cream, due to the large surface of fat emulsion and the strongly adsorbing protein-lipid layer on the milk fat globules, is one of the most effective materials known for adsorbing odors (Lasztity, 2014). The presence of strong smelling silage in or near the milking shed should be avoided. The animal sheds should be well ventilated as milk can also absorb bad odor present in poorly ventilated byre.

### **Digestive disturbances leading to *wai bade***

Disturbances in digestive system commonly lead to disturbances in the four humors in the body. This condition is colloquially known as *wai badee* in Punjab and is characterized by slight drooling of saliva, discharge from the eyes, a slight reddish ting of skin and bad odor from the mouth and in the milk.

### **High concentrate feeding and feeding of roughages with strong smell (e.g. maize or grass silage)**

These days, large and modern dairy farms are rapidly increasing in number in Pakistan/India. The management of these farms provides a larger proportion of animal feed in dry form (as hay and concentrate) instead of as pasture grazing, green fodder and silage. In general, dry feeds produce milk with greater susceptibility to oxidized and rancid flavors than do succulent feed (i.e. green fodders). High concentrate feeding to meet the nutritional needs of high producing cows and buffaloes increases the concentration of unsaturated fatty acids in milk fats, with a parallel increase in the chances of oxidation of milk fat leading to off flavor of milk due to rancidity. Sudden change to a new, strong smelling roughages (such as from

alfalfa hay to maize or grass silage) may also lead to off-flavor in milk. Feeding green maize (corn) fodder can also lead to off-flavor in milk.

### **Long time interval between milk production and processing**

Transportation of milk over long distances usually increases the time between milk production and delivery to milk processing plants. The long storage time of milk even under low temperature may lead to appearance of off-flavor in milk due to oxidation and rancidity of milk fat.

### **Hydrolytic rancidity, oxidative rancidity (autooxidation) and light activated off-flavor**

Hydrolytic milk rancidity occurs when the enzyme lipoprotein lipase hydrolyzes milk lipids resulting in the release of free fatty acids in the milk. This type of milk rancidity is detected by Acid Degree Value (ADV) test that measures the amount of free fatty acids in the milk. When the ADV value is  $>1$ , the milk will have a noticeable rancid flavor due the presence of short chain fatty acids. Milk rancidity is caused by a weakening of the milk fat globule membrane (MFGM). The MFGM, which is composed of phospholipids and protein, protects the lipids from the activity of lipoprotein lipase. High ADV test values (indicative of hydrolytic rancidity) are primarily associated with milking equipment problems that result in rough handling of milk leading to rupturing of MFGM. Excessive agitation of milk is a common cause of hydrolytic rancidity of milk. Important contributing factors include dietary deficiencies of phosphorus, energy, proteins, high somatic cell count and increase in the percentage of cows or buffaloes in late lactation (Baker, 1990). Rancidity due to oxidization of milk lipids is another type of milk rancidity. The milk affected with oxidized flavor has a tallowy,

metallic or cardboard like off-flavor which may be detected by smell but preferably by taste. The factors generally implicated include contamination of milk with copper, iron, rust (from components of milking equipment), exposure to sun light (which causes damage to riboflavin present in milk) and excessive incorporation of air in the milking system. Milk from some cows becomes oxidized spontaneously. Contamination of milk with iron and copper can lead to the production of unconjugated, unsaturated carbonyl compounds as a result of oxidation of milk lipids (Lasztity, 2014).

### **Diagnosis of the causes of bad odor/bad taste in milk**

Diagnosis of the causes of bad odor/bad taste in milk is often difficult. Generally, if the bad odor/bad taste is strong directly after milking, the cause is probably in the feed, or the accidental addition of detergents, disinfectants, etc., to the milk. If the bad odor/bad taste becomes progressively worse over the 24 h after milking, the cause is probably bacterial or enzymatic and only rarely chemical (e.g., oxidation catalyzed by copper). Further microbiological investigations may help in determining the etiologic nature of bacteria involved (Lasztity, 2014).

## **TREATMENT AND CONTROL**

### **Withholding suspected feed for 2 to 5 h before milking**

The time interval between feeding and milking of cows/buffaloes is an important factor that affects the severity of odors in milk. The bad odor and bad taste in milk is most pronounced when the putative silage is fed 2 to 3 h before milking. The feed suspected for causing bad odor or bad taste in

milk should not be fed 2 to 5 h before milking. It is recommended that the suspected feed or fodders containing weeds should be fed immediately after milking.

### **Adding wheat straw to green fodder**

Reducing green fodder and increasing the amount of wheat straw generally decreases the intensity of bad odor and bad taste in milk.

### **Vitamin E supplementation**

Green succulent fodders containing vitamin E should be fed when oxidized flavors occur in milk. In many instances, oxidized flavor development may be stopped by feeding cows/buffaloes 1 to 2 grams of alpha-tocopherol acetate (a stable form of vitamin E) per day per animal in the concentrate, (<http://www.farminfo.org/dairy/flavor.htm>).

### **Recommendations related to milking machine and milking**

Use only high-quality stainless steel, glass, plastic or rubber for all milk contact surfaces. Keep fittings tight and air admission to a minimum. Restrict air admission and prevent equipment leaks. Water treatment/softening may be necessary when water contains abnormally high iron, copper levels. Use iodophor sanitizers preferably. Protect milk from exposure to sunlight or fluorescent lighting; cover glass pipelines. Immediately after milking, cool the milk to at least 40°F (4.4°C) and maintain milk at this temperature (Schroeder, 2012).

### **Phosphorus supplementation**

Increasing dietary P to 0.47% of feed dry matter often resolves the problem of bad odor and bad taste in milk (Baker, 1990).

### **Feeding cows and buffaloes on ration containing**

### **adequate energy and protein**

Feeding of a ration containing adequate levels of energy and protein was shown to correct the problem of lipolytic rancidity of milk (Baker, 1990).

### **Weed control**

When weeds are the suspected cause of bad taste or bad odor in milk, the use of weedicides e.g. (Atlantis<sup>®</sup>, Bayer Crop Science, Private, Ltd., Pakistan) should be considered.

### **Administration of antioxidants**

The cows and buffaloes which are producing bad flavor or bad tasting milk should be treated with the following by the recipe: Dissolve 15 sachet of Mucolator<sup>®</sup> (Acetylcysteine; 200 mg per sachet; Abbot Lab. Ltd. Karachi) in 500 ml of distilled or mineral water (e.g. Pure Life<sup>®</sup>, Nestle). Filter this solution through 2 to 4 layers of muslin cloth. Add this filtered solution to one liter bottle of dextrose 5% solution and inject intravenously. After 30 minutes, administer 20 tablets of vitamin C (e.g. Tab. Cecon<sup>®</sup>, Abbot Lab.) in the form of a drench. Repeat intravenous administration of Mucolator<sup>®</sup> and oral administration of Tab. Cecon<sup>®</sup> for next 2 to 3 days.

### **Carminative detoxifying mixture**

The following recipe given weekly often comes very handy in preventing and treating bad odor and bad taste in milk:

Omum (*Ajwain* in Urdu) = 100 g

Cumin (Carawy; *Zeera* in Urdu) = 30 g

Ginger = 100g

*Swertia chirata* (*Chirata* in Urdu) = 30 g

Aniseed (*Saunf* in Urdu) = 60 g

Green pepper (*Haree murch* in Urdu) =

120 g

Black pepper (*Kali murch* in Urdu) = 10 g

*Citrullus colocynthis* (a very bitter medicinal plant known as *Tumma* in Urdu) = 60 g

Sodium bicarbonate = 100 g

Common salt = 100 g

Zinc Sulphate = 3 g

Grind and then mix all the above ingredients in one liter of water and give as a drench on weekly basis.

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