



**FACTORS AFFECTING
QUALITY AND YIELD OF KHOA**

Khoa contains fairly large quantities of muscle building **proteins**, **bone forming minerals and energy giving fat and lactose**. It has got, in concentrated form, most of the fat soluble vitamins and many water soluble vitamins contained in the original milk.

Chemical Composition of Three Varieties of Khoa

Constituent %	<i>Pindi</i>	<i>Dhap</i>	<i>Danedar</i>
Total solids	65.0	56.0	61.5
Fat	22.5	19.4	20.9
Proteins	19.5	17.1	18.4
Lactose	19.4	16.7	18.9
Ash	3.5	2.9	3.4

Physical quality of cow and buffalo *khoa*

Particulars	Cow	Buffalo
Colour	Pale yellow to slight brown	Whitish to light cream tinge
Appearance	Moist surface	Tinge
Body	Slightly hard	Oily or greasy surface
Texture	Slightly open	Smooth, Soft, Slight granular
Odour	Rich, nutty	Nutty rich
Taste	Slightly salty	Sweet



Yield of Khoa

Generally 4 kg of buffalo milk or 5 kg of cow milk yield one kg of *khoa*. The yield of *khoa* depends on the following factors:

Type and quality of milk

Buffalo milk gives more yield than cow milk because of its higher fat and solids. Adulterated milk and low solids milk give lower yield.

Moisture content in khoa

Higher moisture content in *khoa*, higher the yield and vice – versa. Yield of dhap variety of khoa is more than Pindi variety of *khoa* because of higher moisture content.

Losses during handling

Higher losses due to stickage of product and milk spillage losses during processing which will result in lower yield.

Factors Affecting Quality of Khoa

Higher amount of free fat (>60%) gets released in buffalo milk khoa than cow milk khoa. Higher free fat content contributes to soft body and oily or greasy appearance to buffalo milk khoa. **Good quality khoa should have either a light yellow (if made from cow milk) or a dull white colour if made from buffalo milk), slightly heated flavour, but free from oiliness and acidic taste, smooth body and a compact mass of very small uniformly sized grains. Should not have visible water droplets or show sign of oozing of fat. Fresh should be able to produce a smooth homogenous paste on working, which indicates that it is suitable for sweet making.**

Quality of Milk:

Species of animal:

- Buffalo milk is preferred over cow milk for khoa making because it yields a product with soft, loose body and smooth granular texture which is highly suitable for the preparation of sweets.
- Average yield from buffalo milk is 21.6-23% and from cow milk it is 18.3-18.5% due to higher T.S.
- Khoa from cow milk is of inferior quality due to its dry surface, sticky and sandy texture and salty taste (due to higher chloride and citrate content (Citrate buffalo milk 0.18%, cow milk 0.18% and chloride: buffalo milk 0.07% and cow milk 0.10%) which is not considered suitable for manufacturing sweets.



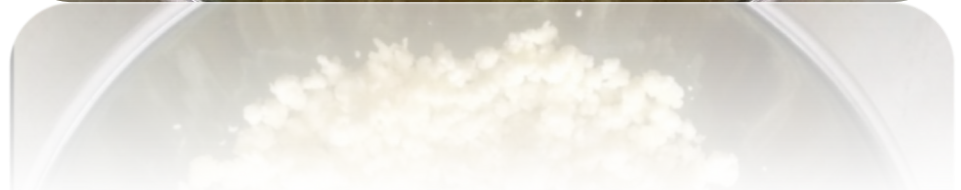
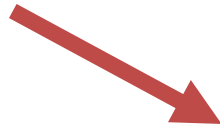
Fat content in milk:

- **Minimum fat level of 4% in cow milk and 5.5% in buffalo milk is essential for production of khoa with desirable body and texture and meet FFA requirements also.**
- **Lower fat content results in undesirable hard body and coarse texture in finished product which is not suitable for good quality sweets preparation.**
- **Fat level higher than minimum improves quality of final product. (Higher emulsifying capacity of buffalo milk fat due to presence of higher proportion of butyric acid containing triglycerides (50%) than only 35% in cow milk fat and higher fat content in buffalo milk is responsible for smooth and mellow texture of buffalo milk khoa).**

Acidity of milk:

- Fresh sweet milk yields the best quality khoa, while developed acidity in milk produces an undesirable, coarse texture sour smell and bitter taste in to the khoa which is unsuitable for sweet preparation.

Khoa from spoiled milk



Presence of additives and adulterants:

- **Neutralization of high acidic milk** improves the texture, but does not improve flavour of *khoa*. Further it gives saltish taste in the final product.

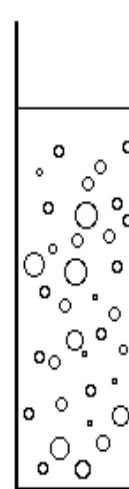
Presence of colostrum in milk effect on colour of *khoa*, which is deep yellow with cow colostrums. It also gives pasty texture in the final product making it not suitable for sweet making.

- **Adulteration of milk with water** produces a brown *khoa* and a proportionate reduction in the yield. Texture and flavour of *khoa* are not affected much when adulterated with starch the physical quality of *khoa* is considerably affected. Develops a harder body and a pasty sticky texture not suitable for the preparation of confections.

- **Speed of Stirring** should be optimum. Depends on the type of machine/ method. In traditional method, optimum speed is about 100 rpm where as in continuous systems it depends upon the type of machine used. Optimum speed of stirring prevents burning of milk solids and helps in developing desirable body and texture in *khoa*. Low speed results to the burning of *khoa*. Higher speed makes the product pasty and sticky.
- **Temperature of desiccation:** Milk should be maintained at boiling temperature till it reaches a paste consistency and then temperature is lowered to 88°C till the pat formation stage. The dehydration should be stopped when the pan contents starts leaving the pan surface and shows a tendency to stick together. Continued heating at higher temperature at advanced stage of *khoa* making results into brown, undesirable flavour (cooked) and texture (hands dry). Slow heating is not only more time consuming but also produces sandy texture and brown colour.

Homogenization of milk:

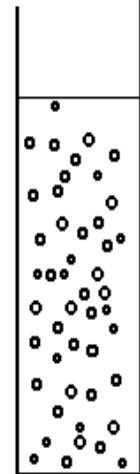
- Homogenization of cow/ buffalo milk produces a softer body in khoa, as against an homogenized milk.
- Khoa from homogenized milk also shows lower fat leakage, less browning, and a reduced patting tendency as compared to that obtained from unhomogenized milk.



Raw milk



Cold, raw milk after 1 hour



Homogenized milk during storage

Physico-Chemical Changes in milk during Khoa making

Changes in physico-chemical characteristics of milk during khoa making take place due to 1) concentration 2) heating and 3) Stirring and scraping



- **Change of state:** Removal of moisture from milk results into concentration of milk solids. All the constituents including lactic acidity increase in proportion to the degree of concentration. pH decreases.
- **Development of cooled flavour:** Heating of milk causes changes in proteins resulting in production of sulphhydryl compounds by denaturation of whey protein particularly β -lactoglobulin.
- **Coagulation of casein:** Due to combined action of heat and concentration, coagulation of casein tends to increase logarithmically with milk solids concentration and forms a complex with denatured whey protein.

Convention of soluble calcium and phosphate to colloidal form and interaction between protein compounds

Super-saturated solution of lactose: Lactose is present in khoa as a super-saturated solution. Most of the lactose is present as α -hydrate in khoa.

Free fat formation: Free fat in khoa is 60% of the total fat in khoa, (Cow khoa = 50% of the total fat). By vigorous stirring and scraping, the fat globule membrane ruptures, thereby releasing considerable amount of free fat in khoa.



Increase in iron content

From 2-4 ppm iron content in milk, iron content of *khoa* increases more than 100 ppm due to the incorporation of additional quantities of iron from *karahi* and *khunti* by vigorous scraping.



Change in colour intensity

Khoa becomes intense with brownish tinge due to formation of melanoiodins pigment. Browning reaction is maillard type reaction due to interaction between aldose group of lactose and free amino group of casein