



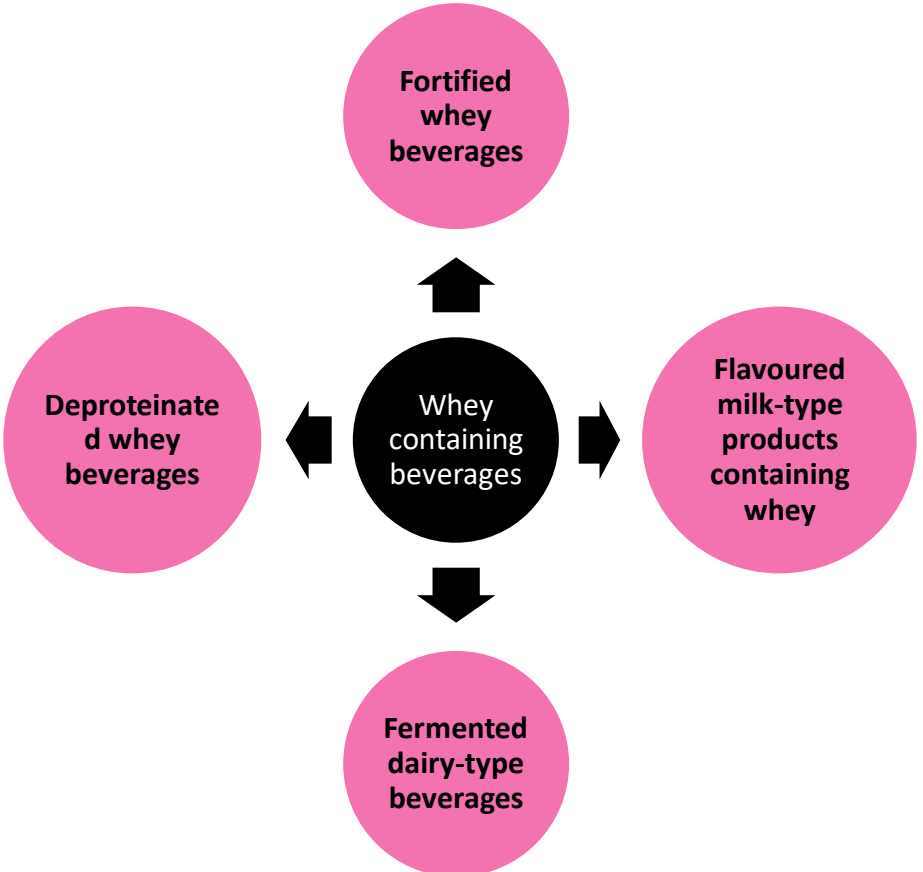
Whey processing: Fermented products and beverages from whey



- **Whey beverages** include wide range of products obtained by mixing of native, sweet or acid whey, deproteinised whey and whey powder with different additives (apples, pears, strawberries, cranberries), crops and their products (mainly bran), isolates of vegetables proteins, chocolates, cocoa, vanilla extracts and other aromatizing agents.
- **Advantages: Healthful combination of fruit base, vitamin containing components, dairy based calcium and whey proteins.**



Also includes dietetic beverages, drinks with hydrolyzed lactose and powder drinks



Whey
based beverages are broadly classified:

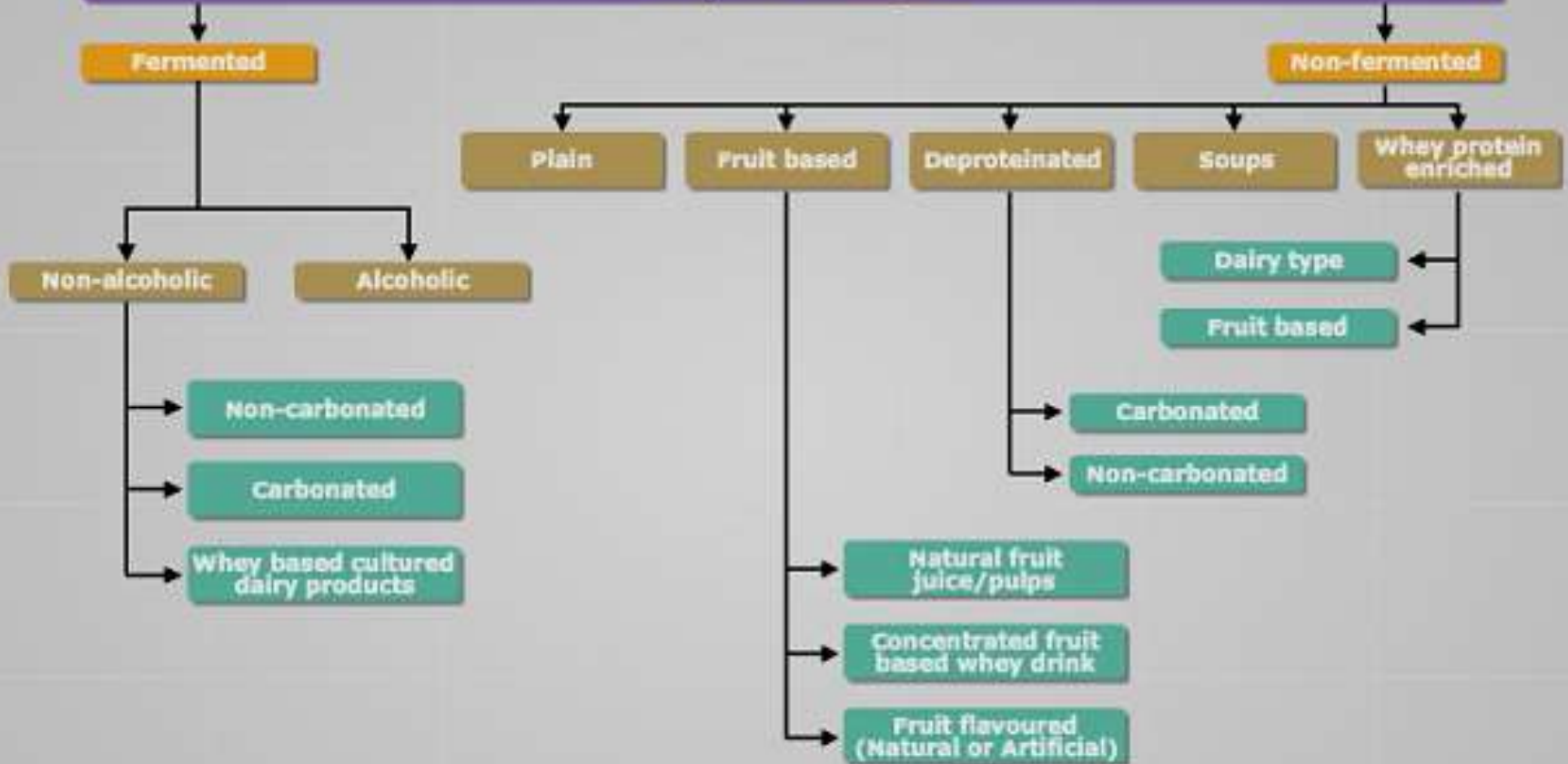


- **Fermented**



- **Non fermented**

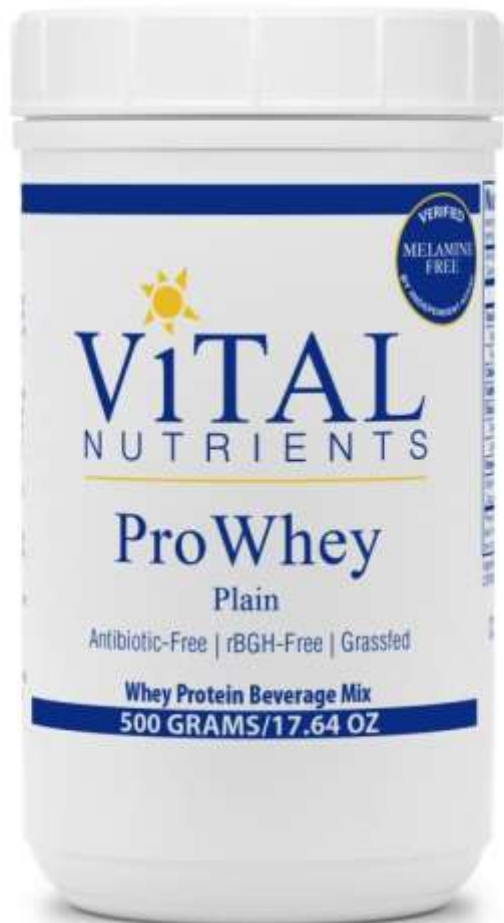
Whey based beverages



Classification of whey beverages

Plain whey beverages

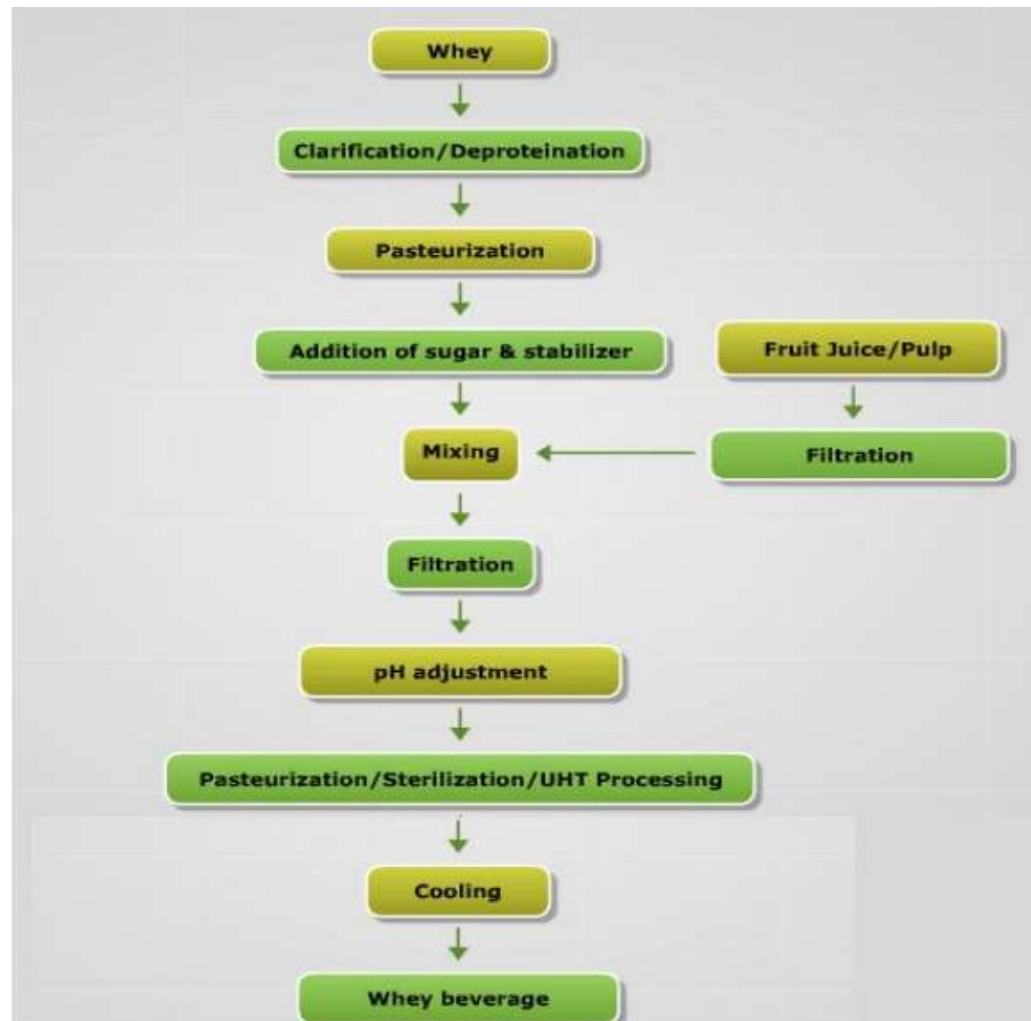
- Plain whey beverages include mixing of whole whey along with sugar, flavour (synthetic or natural) and colour.
- May or may not be carbonated.



Whey based fruit beverages

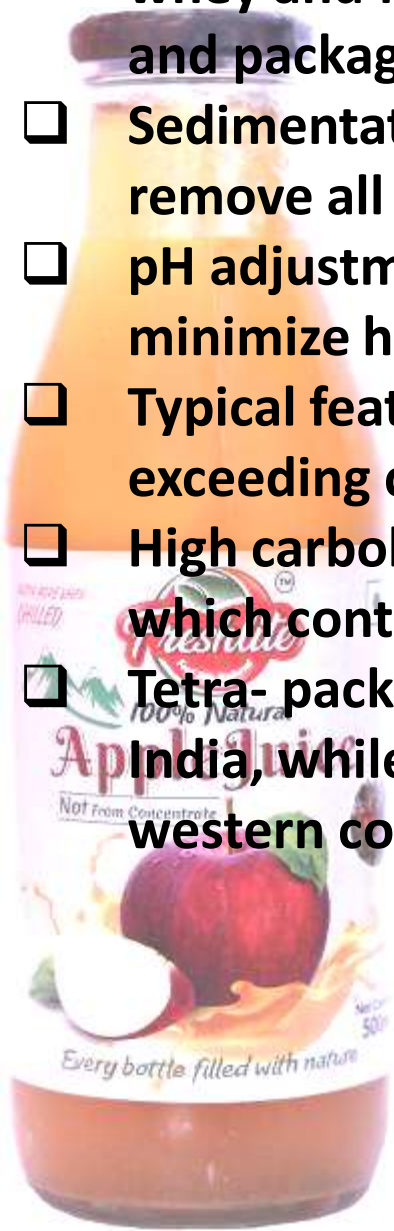
Whey based natural fruit juice/pulp drink:

- Whey based fruit beverages are manufactured by mixing of appropriate fruit pulp/ juice or juice concentrate and processed whey.



Flow diagram for production of fruit whey beverage

- ❑ Common operation for manufacture of whey based beverage is to blend whey and fruit juice components, followed by proper heat processing and packaging.
- ❑ Sedimentation problem can be removed by centrifugal clarification to remove all sedimentable casein fine particles.
- ❑ pH adjustment in heat processed long shelf life beverage is important to minimize heat induced whey protein precipitation.
- ❑ Typical features: Low protein and high total carbohydrate content, often exceeding carbonated soft drink/fruit juice product.
- ❑ High carbohydrate content is result of high lactose content of whey, which contributes little to product sweetness.
- ❑ Tetra- pack paper based containers of 200 ml capacities predominate in India, while 250/500 ml plastic cups with aluminium foil are used in western countries.



Product name	Type	Characteristics
Frusighurt	Fruit, artificial sweetener	Germany Whey + 10% apple/ lemon juice
Mango-molke-mix	Fruit	Whey and mango juice, Bifidobacterium culture
Frucht-molke (Heirler)	Fruit	Available in health food store, several varieties (peach, maracuya, passion fruit, apple)
Frucht-molke (Immensee)	Fruit	Whey + 15% blackcurrant (juice) or 25% fruit mix juice (orange, pineapple, apricot, apple, banana, grapefruit, mango, peach, papaya, lemon)
Kur-molke	Fruit, artificial sweetener	Apple or orange
Multivitamin-molke	Fruit, artificial sweetener	Whey with juice from 10 fruits and 10 vitamins added
Molke-frucht nektar	Fruit	Whey + 25% orange
Fit	Fruit	Switzerland Whey and grapefruit (15%) or mango juice
Latella	Fruit	Austria Whey with mango and grapefruit/ lime juices
Morea	Fruit	France Whey concentrates with 40% juice mix of mango, guava, kiwi, and passion fruit
Djoez	Fruit	Holland Whey (80%), fruit juice concentrate (12.8%), flavouring
Taksi	Fruit	Whey (85.3%), tropical fruit juice concentrate (6.3%), colouring
Hedelmatarha	Fruit	Finland Lactose-hydrolysed whey mixed with a mango or a tropical fruit juice mix

Whey - fruit beverage products marketed in Europe



Concentrated fruit based whey beverages:

- ❑ Developed to deliver product in more convenient form, minimize transportation and packaging requirement and improve protein content.
- ❑ For preparing such products, whey is concentrated in vacuum pan or evaporators, mixed with fruit juice concentrate, sugar and other additives, heat treated and packaged.

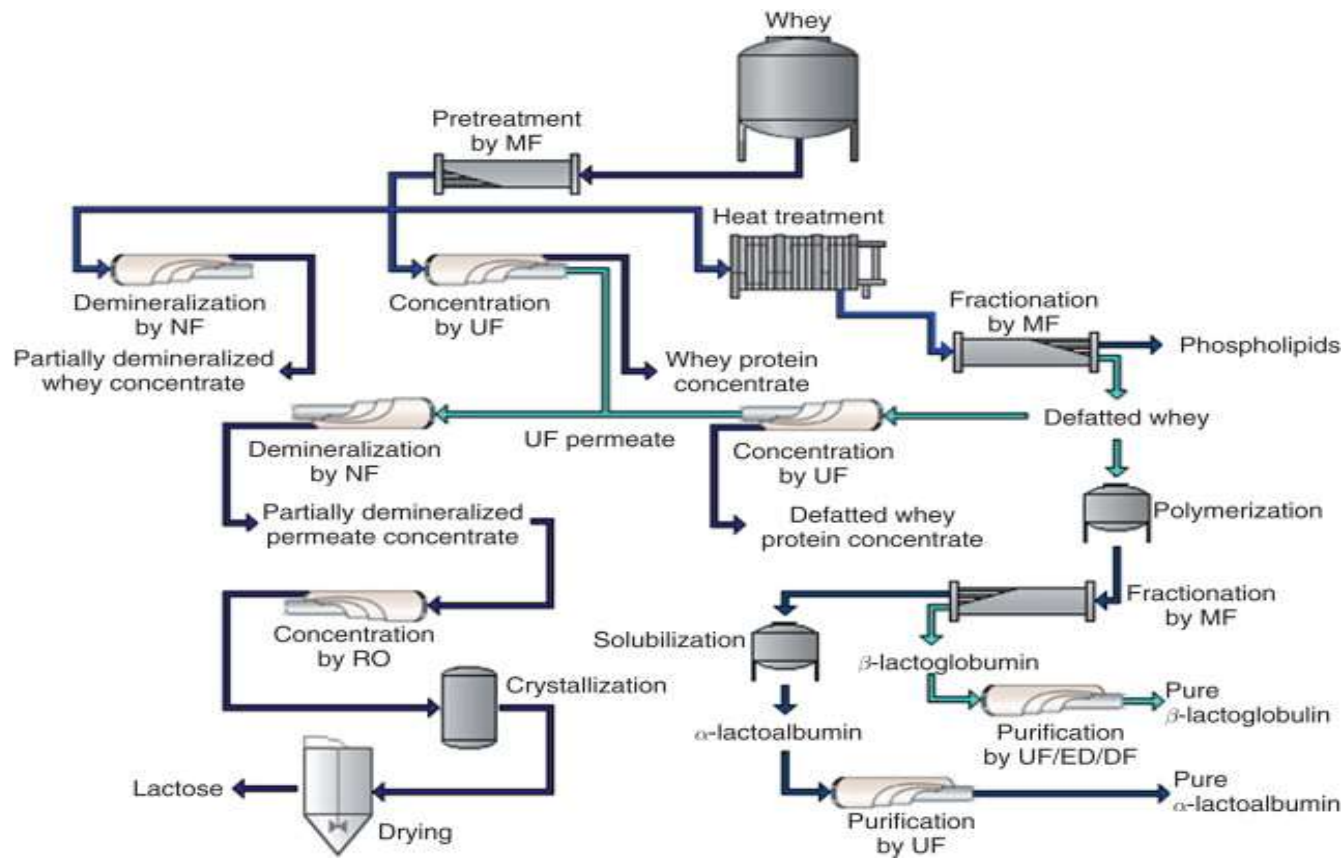
Fruit flavored drinks:

- ❑ Different types of fruit flavours are used which may be artificial/natural.



Deproteinated whey beverages

- ❑ Whey permeate which is obtained during whey protein preparation using ultrafiltration process, can be an ideal starting material for development of such products.
- ❑ Can be carbonated and non-carbonated beverages.
- ❑ Beverages made with whey permeate are higher in electrolytes (Na, K, Zn, Mg, P) compared with commercially available sports beverage.

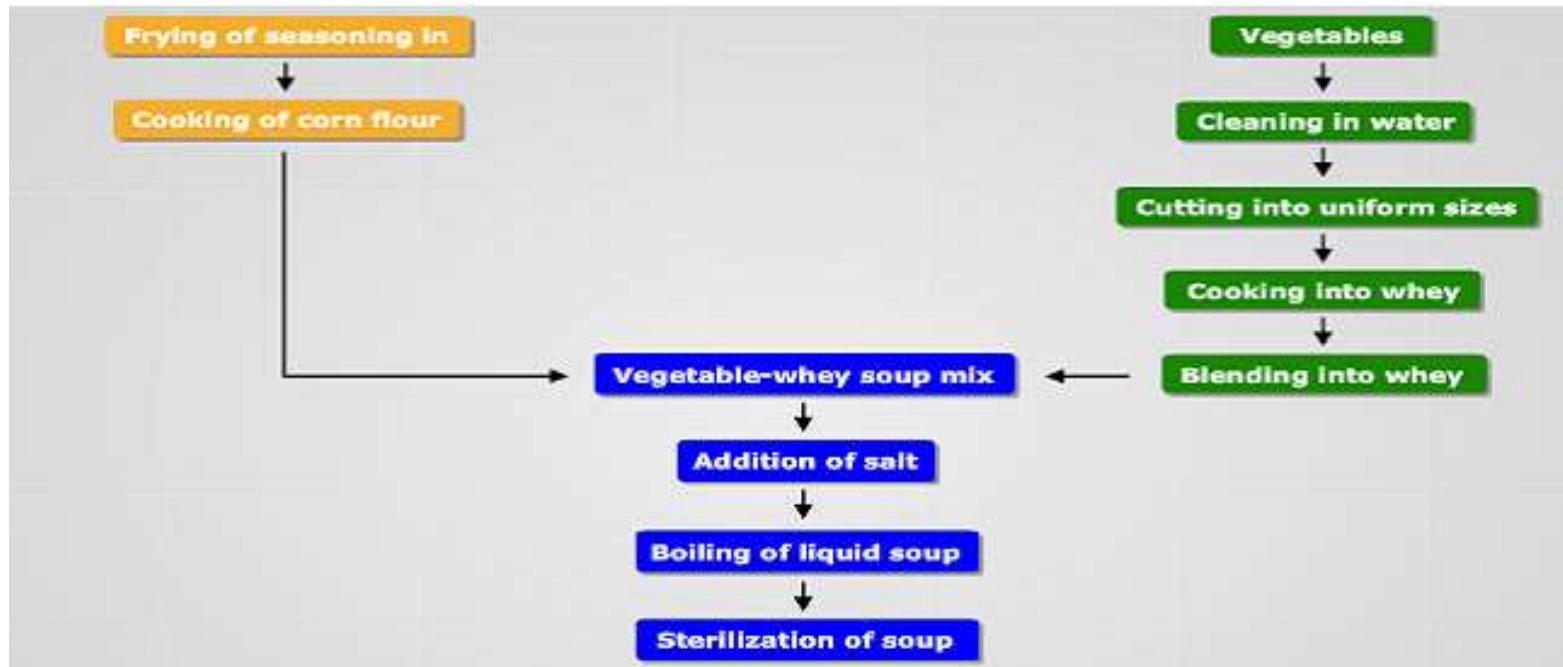


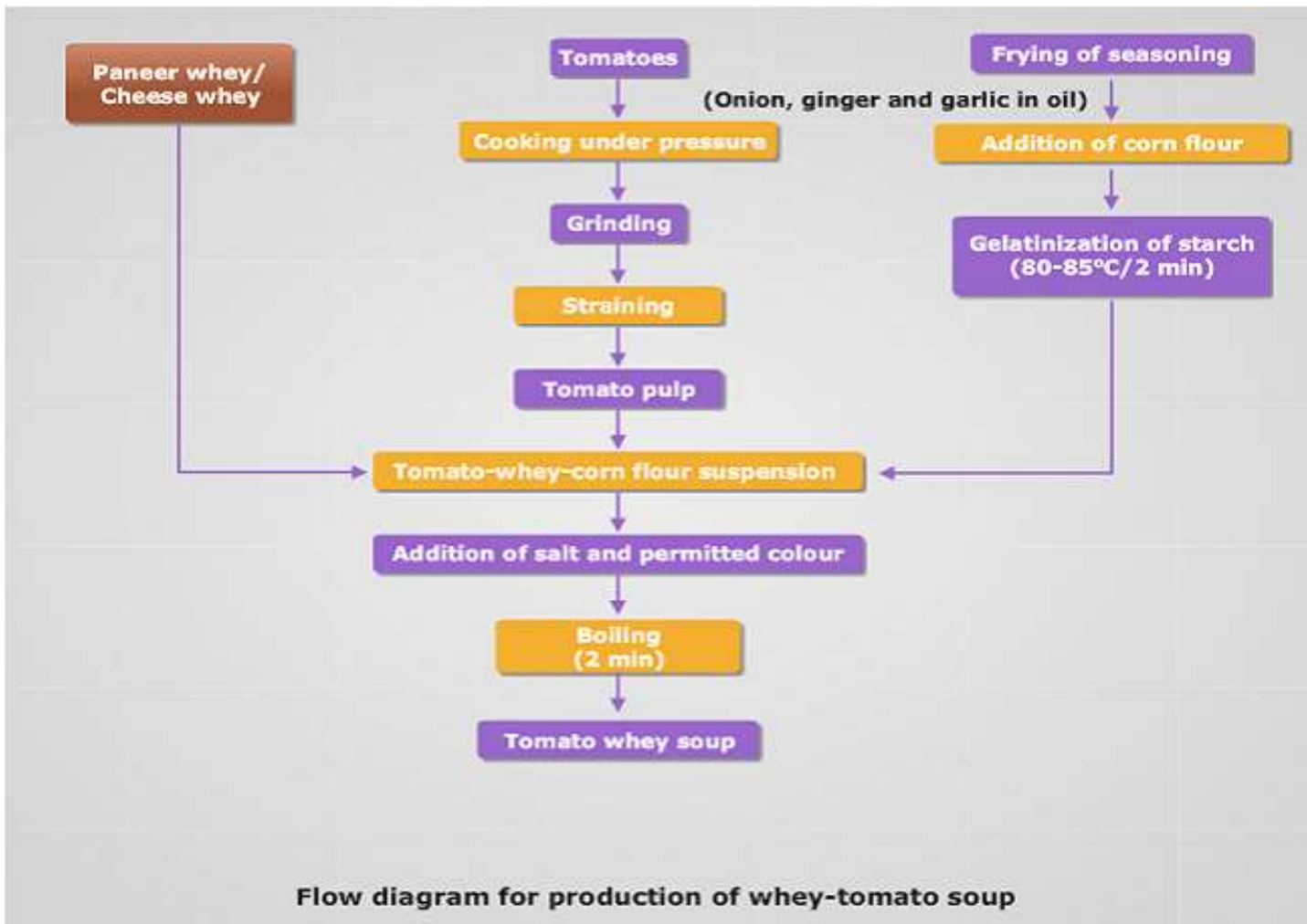
Whey protein enriched whey beverages

- Whey protein is used to increase protein content of whey based beverages.**
- Swedish Dairy Cooperative developed and marketed a protein rich fruit drink called “Nature’s Wonder”.**
- Produced by mixing high-grade whey protein, hydrolyzed lactose and pineapple, orange and passion fruit juices.**
- Whey in the form of high protein dry whey powder or concentrate is used for preparation of both dairy type or fruit based beverages.**

Whey based soups

- ❑ Sequence of operation involves: **blending of vegetable in whey and cooking of corn flour followed by heat processing.**
- ❑ Time-temperature combination for cooking of vegetables, corn flour and seasoning is important for proper dispersion of vegetables, gelatinization of starch and flavour perception of soups, respectively.
- ❑ Development of long shelf life soup involves **proper sterilization of soup.**
- ❑ **Whey based soup powders:** Cooking of vegetables in concentrated whey, mixing of blended vegetables in whey, frying of seasonings, gelatinized starch followed by spray drying.





Commercial soup powders are available as a result of blending of dried vegetables in gelatinized starch. Cheese whey more preferable for manufacture of vegetable soups than paneer whey. Reason could be low pH of paneer whey that resulted in acidic product not usually compatible with most vegetables. Whey based soups are more viscous as compared to water based most probably gelation of whey proteins on heating.

Fermented Whey Beverages

How to Make Lacto-Fermented Lemonade
from Whey????????



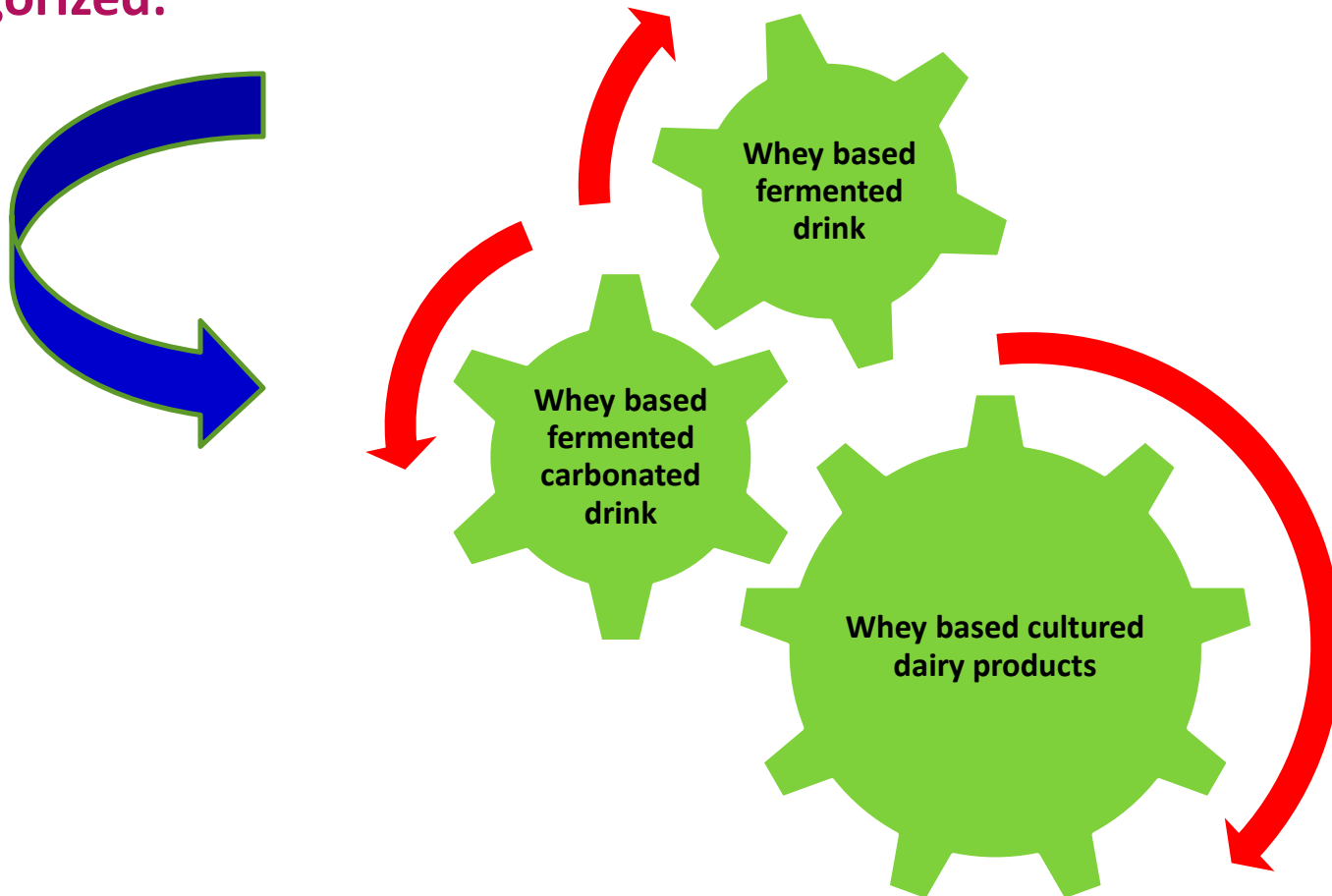
Fermented whey beverages have been classified:



Preparation of Fermented Whey Beverages

Non-alcoholic whey beverages:

- ❖ These beverages are obtained by fermenting lactose in whey to lactic acid by lactic acid bacteria.
- ❖ Categorized:

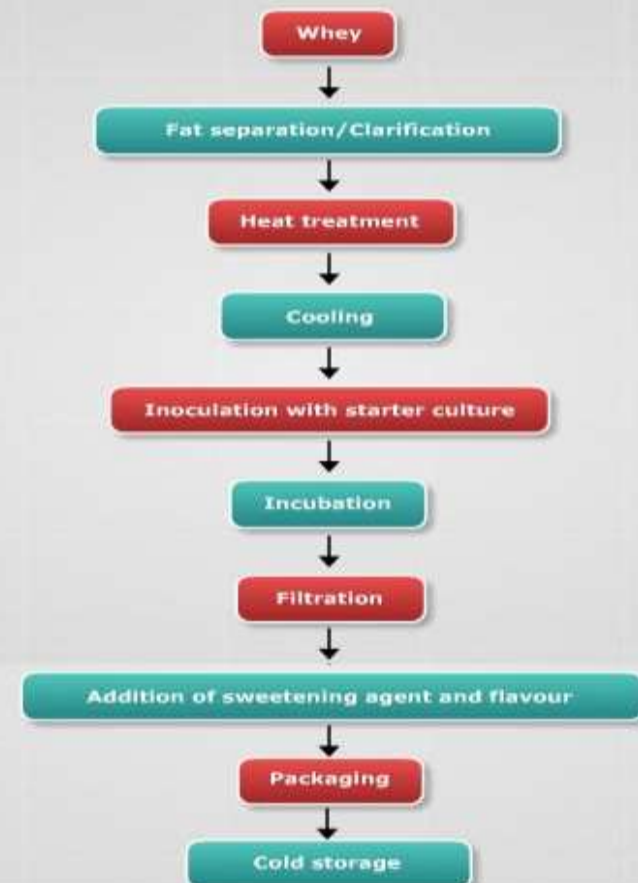


a. Whey based fermented & carbonated drinks:

Product	Type	Characteristics
Rivella	Whey based fermented carbonated drink	35% deproteinated whey serum + water, sugar and flavor
Surelli	Whey based fermented carbonated drink	Almost same as rivella
Fauna-fit	Soft drink type	Approx. 85% sweet whey UF permeate fermented & after second UF mixed with fruit juice (mango, pineapple, strawberry)
Whey kwas	Alcoholic kefir like drink	Deproteinated whey inoculated with thermophillic starter and then treated with yeast
Servovit	Whey based cultured dairy products	Carbonated product based on whey and cultured buttermilk
Kumiss like beverage	Whey based fermented drink	Whey + buttermilk inoculated with culture comprised of kumiss yeast <i>L. bulgaricus</i> and <i>L. acidophilus</i>
Milone	Whey based fermented drink (mildly alcoholic and sweet sour in flavour)	Whey + 1% lactic acid + equal amount of tea, copp th , remaining liquid is then incubated with lactose fermenting yeast (0.8% ethanol)
Alcoholic whey beer	Beer like beverage	Whey beer brewed with hops but without added malt
Malted whey beer	Beer like beverage	Malt and hops both were added to whey and fermented with bottom yeast
Whey malt beer	Beer like beverage	50% whey + malt, hop, sugar and coloring matter (produced with top fermentation)
Whey nutrient beer	-----	Whey + hops and nutrient salts (low alcoholic product)
Whey champagne	Alcoholic wine like	Deproteinated whey inoculated with 0.1% fresh baker's yeast + addition of coloring and flavouring substance
Whevit	Alcoholic soft drink	Whey is fermented with yeast culture (<i>Saccharomyces cerevisiae</i>), can be carbonated and non carbonated
Acidowhey	Non carbonated soft drink type	Whey fermented with lactic acid bacteria and free from preservative and synthetic color

Some famous whey based fermented beverage in the world

Flow diagram for production of whey based fermented beverage



b. Preparation of fermented whey drink ‘Acidowhey’:

- ❖ A palatable soft drink “Acidowhey” from whey was developed at NDRI, Karnal.
- ❖ “Acidowhey” is non-carbonated drink, fermented with selected strain of LAB and retaining all nutrients of whey intact.
- ❖ Whey from paneer, cheese, chhana or casein manufacturing is first separated to remove fat and traces curd particles.
- ❖ Clarified whey is heat treated to 85-90 C for 10 min or its equivalent combination.
- ❖ Clarified whey after cooling to 40 C is inoculated with an active culture of *L. acidophilus* and incubated at 40 C.
- ❖ After incubation, fermented whey is clarified to remove precipitated cellular mass, whey protein and minerals formed during process.
- ❖ Sugar is then added to product 10-12% in form of 50% sugar syrup (pasteurized).
- ❖ Desirable amount of pineapple/citrus flavor is added and beverage is chilled to 4 C and packaged.
- ❖ Beverage should be pasteurized before packing or alternatively pasteurized in container.
- ❖ Antibacterial properties of “Acidowhey” against *Micrococcus flavus*, *S. aureus*, *E. coli* and *Bacillus subtilis* is studied.



Flow diagram for production of acidowhey

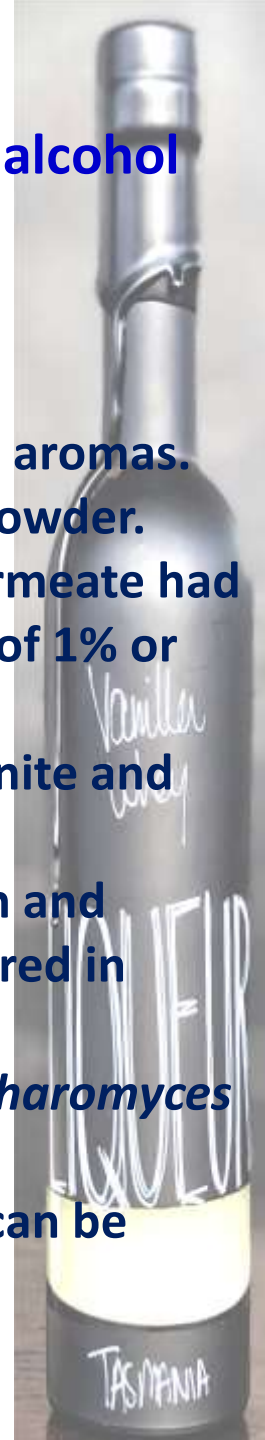
1. Fruit-flavoured drinkable yoghurt offers an excellent opportunity for incorporation of whey into products.
2. Compatibility of whey - especially of acid whey and/ or further fermented sweet whey-with character of cultured dairy beverages makes such approach particularly attractive for dairy processors.
3. In addition to whey based yoghurt drink prepared by culturing mixture of regular milk and an ultrafiltration whey protein retentate containing same protein content as milk are another example of whey -containing cultured dairy beverages.

Alcoholic whey beverages:

- ❖ **Alcoholic whey beverages** include drinks with small amount of alcohol (to 1.5%), whey beer, whey wine and whey champagne.

a. Whey wine

- ❖ Contains low alcohol amount (10-11%) and mostly flavored with fruit aromas.
- ❖ Made from demineralised UF permeate or reconstituted acid whey powder.
- ❖ In reconstituted acid whey powder, protein is removed by UF and permeate had a total solids conc. of 26 -28% before demineralizing to mineral level of 1% or less.
- ❖ Any residual whey taints after fermentation are removed with bentonite and charcoal.
- ❖ For sweet whey wine, whey is deproteinized, heated at 82 C for 5 min and approx. 22% dextrose added depending upon amount of alcohol desired in wine.
- ❖ Fermentation is completed in 7 days at room temperature using *Saccharomyces cerevisiae* spp. *ellipsoids*.
- ❖ Whey based wines like **pop wine**, **whey champagne**, **sweet wine** etc can be prepared by using different yeasts and processing conditions.



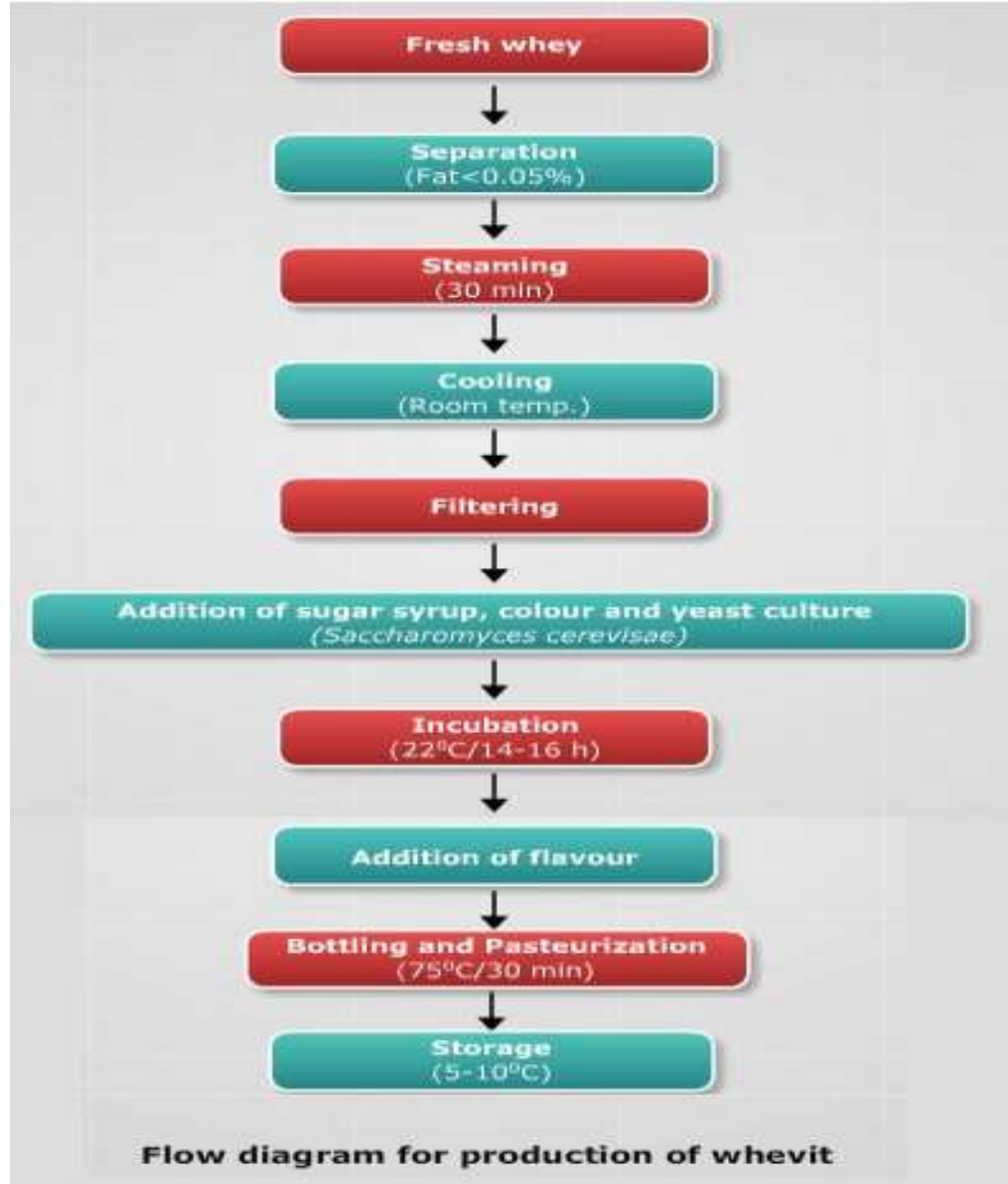
b. Beer like whey beverage:

- ❖ Whole whey or whey concentrate can be used as suitable substitute ingredient of cereals in manufacturing of beer and beer like products.
- ❖ Whey have certain materials similar to colloids of beer wort and has great capacity for binding carbonic acid.
- ❖ On prolong heating under pressure, it develops caramel like flavor, which is similar to taste and odour of cured malt.
- ❖ Dietrich (1988) developed beer substitute by making 5.4% malt wort with 2.5% deproteinized whey. Malt whey mixture fermented by *Saccharomyces lactis*. After 5-7 days, product developed a true beer flavor.



c. Whevit- A nourishing soft drink:

- ❖ Manufacturing process of whevit: Fresh whey obtained from chhana (or paneer) making is passed through cream separator, and separated whey is steamed for 30 min in double jacketed vat.
- ❖ Cooled to room temperature and kept overnight to allow precipitated proteins to settle down, and filtered through muslin cloth.
- ❖ 50% sugar syrup @ 22-23% of whey, 10% citric acid @ 2-2.1% of whey and sugar mixture, selected colour and flavours in requisite amounts are added.
- ❖ Mixture is inoculated with *Saccharomyces cerevisiae* @ 1% of yeast whey broth (whey broth is prepared by adding 1% sugar in filtered whey and sterilizing at 15 lb pressure for 15 min); inoculum is prepared by inoculating it with yeast culture and incubating it for 48 h at 25 C).
- ❖ After mixing inoculum in whey, incubated at 22 C for 14-16 h.
- ❖ Product is then filled in bottles leaving about 5% air space.
- ❖ Bottles are then crown corked to retain CO₂ and pasteurized at 75 C for 30 min in hot water, cooled and stored at 5-10 C.



NDRI, Karnal, have developed soft drink out of whey known as “Whevit”

To meet situation where cultivation of yeast and fermentation of whey is not practicable, process has been modified to incorporate CO₂ through carbonated plant.