SOY MILK OBTAINING AND COMPARATIVE CHARACTERIZATION WITH COW'S MILK

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Abstract. *This paper aim was to obtain soy milk through traditional methods, from soybeans (non-hydrated), purchased from Timisoara market and grown in West Romania area. Soy milk was analyzed of sensory and physical-chemical point of view. The results obtained were compared with sensorial and physical-chemical indicators established for dairy milk by law.*

Keywords*: soymilk, cow's milk, organoleptic characteristics, physical-chemical indices.*

INTRODUCTION

Soy milk, also called soymilk or soya milk, have vegetable origin and is produced by soaking the dried soy beans and grinding them in water.

A traditional staple of East Asian cuisine, soy milk is a stable emulsion of oil, water and protein. Soy milk can be produced at home using a soy milk machine.

Soymilk (*doujiang*) is originated in China, probably during the early Han dynasty (202 BCE to 9 CE), after the rotary millstones was introduced and was widely used to grind wheat (HUANG, 2008) .Soy milk has high amounts of protein having about the same amount of protein as cow's milk; it can replace animal protein and other sources of dietary fiber, vitamins and minerals (SACKS ET AL. 2006).

Soy milk contains low digestible calcium because calcium is bound to the bean's pulp, which is indigestible by humans. To counter this, manufacturers enrich their products with calcium carbonate (GREENBERG, 1998). Unlike dairy milk, soy milk has low saturated fat and no cholesterol.

Soy products contain sucrose as the basic disaccharide, which breaks down into glucose and fructose. Since soy does not contain galactose, a product of lactose breakdown, soy-based infant formulas can safely replace breast milk in children with galactosemia ("Soy". US National Institutes of Health, April 30, 2013). Like lactose-free cow's milk, soymilk contains no lactose, which makes it an alternative for those who are lactose-intolerant. It has been suggested that soy consumption is associated with a reduction in low-density lipoprotein ("bad cholesterol") and triglycerides (ANDERSON, ET AL., 1995). Research has refuted claims that soy affects bone mineral density (DARLING ET AL., 2009). Research has found no link between soy and increased estrogen levels in men, although studies thus far have been limited in duration (MESSINA, 2010). However looking at around 2000 years of safe soy milk consumption in China, where hot soy milk soup is a widely popular breakfast food, while the Chinese population is very visibly the fastest growing on earth, any "soy milk causes male infertility" claims should be viewed rather critically.

For people who suffer from gout, moderate consumption of soy, which is rich in purine, is not associated with the development of gout, (SINGH, ET AL., 2011) but high levels should be avoided (http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001405/).

Soy milk is also known as soybean juice, and sometimes referred to as soy drink, is a stable emulsion of oil, water and protein which contains approximately the same proportion of

protein like cow's milk: about 3.5% protein; also 2% fat, 2.9% carbohydrates and 0.5% ash. A cup of soy milk contains about 7 grams of protein, 4 g carbohydrates and 4.5 g of fat. It is rich in protein and contains a considerably higher amount of fiber than cow's milk. The biggest benefit of soy milk is isoflavones, chemical substances similar to estrogen hormones. They are connected with a series of health problems and respond positively to the prevention of certain cancers, heart disease osteoporosis and others (WASCHATKO ET AL., 2012).

Soy milk is sweet having similar taste to cow's milk. The main advantage of a diet rich in soy milk consist in the absence of lactose that can cause allergies. Soy milk is not free of fats having even more than 2% as contain cow's milk, but is free of "bad cholesterol", containing up to 9 times less saturated fat and up to 10 times more acidic healthy fats. The biggest loss of soybean milk is calcium deficiency.

It has about a quarter of the amount of calcium contained in cow's milk. Lactose, the primary carbohydrates from cow's milk can be a problem for some people. They develop lactose intolerance as a result of enzymes lack in the body, enzymes that are necessary in order to develop lactose.

Thus, consumption of certain dairy products can cause gas, bloating and diarrhea, and in these circumstances soy milk is the best alternative (http://www.botanical-online.com/english/soymilk.htm).

MATERIAL AND METHOD

Obtaining of soy milk:

Soy milk was obtained from the whole soybeans which are soaked in water for at least 3 hours. Rehydrated beans were subjected to wet grinding with water in a weight ratio of 1:10. Grist result is boiled for 15-20 minutes, followed by removal of insoluble residue (meal or soybean paste) by filtration.

Characterization of the obtained soybean milk was done by:

- Sensory analysis of dairy products, according to STAS 6345-74**.**
- Physical-chemical indicators followed were:
- Determination of milk acidity through Thorner method according to STAS 6353-75.
- pH determination by potentiometer method, according to SR ISO 11869; 2000; SR ISO 6091, 6092/2008; SR ISO 1740/2008.
- Milk density determination by aerometric method according to SR 2418/2008.
- determination of total dry matter by oven-drying method according to STAS 6344/1988.

RESULTS AND DISSCUSIONS

According to existing laws, the sensorial properties of milk are examined in the following order: appearance, consistency, color, smell and taste

In Table 1 are shown the main organoleptic characteristics of cow's milk and soy milk.

Table 1.

Organoleptic characteristics of cow's milk comparing with soy milk

Characteristics	Cow's milk	Soy milk
Appearance	Homogeneous liquid, opalescent, free of visible objects on surface and no sediment	Homogeneous liquid, opalescent, free of visible objects on surface and no sediment
Color	White with yellowish tint	Yellowish
Consistency	Fluid is not allowed viscous, mucilaginous or philanthe consistency	Fluid
Taste	Pleasant, characteristic, sweet	Pleasant, characteristic, sweet
Smell	Pleasant, characteristic	Slightly taste of soy

Through physical-chemical determination is assessed the ***integrity*** (by determining density, and total dry matter) and the ***hygiene status*** (by determining the acidity and pH).

The physical and chemical quality indicators of soy milk compared with admissibility physical-chemical indicators of milk cows (average) set by law are presented below.

Raw milk intended for industrial processing, must have a minimum density of 1.029 g/mL to cow milk (with values between 1.028-1.033 g/mL); 1.031 g/mL buffalo milk and 1.033 g/mL sheep milk.

With the addition of water in soymilk decreases the milk density and by skimming, the density increases. Knowing the milk density, it can be appreciated the falsification degree by the water addition.

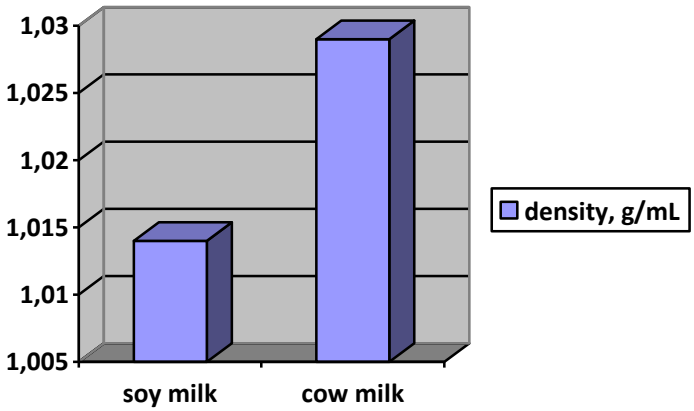

Figure 1. The density of the soy milk and cow's milk

The density of the soybean milk (1.014 g/cm^3) was lower than density of cow's milk (1.029 g/cm^3) (figure 1).

The nutritive value of milk and also the yield in different diary products and their quality depends on the dry matter content. Dry extract, to cow's milk register values between 0.7-13%, with an average of 12.5%.

Determination of total dry matter, according to STAS 6344/1988, is mandatory in case of litigation, through drying oven method (to a temperature of 103 ± 2°C), to a constant weight.

The dry matter content decreases when milk is adulterated by addition of water, through skimming or by double fraud (addition of water and cream).

Following determinations carried out was found that soy milk has a lower dry matter content (8.4%) than cow's milk (12.5%), which suggests that cow's milk has a higher nutritional value than soymilk (figure 2).

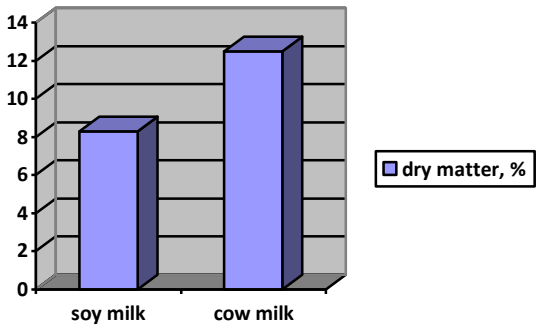

Figure 2. The dry matter content of soy milk and cow's milk

After production, the most important change of milk is acidification due to lactose transformation into lactic acid.

Immediately after milking, the milk is slightly acid, acidity caused by the presence of carbonic acid, hydrogen phosphates and citrates, being an initial acidity.

With the acidity increase (on the glucose transformation into lactic acid) in milk are produced significant changes, rendering it unfit to be transformed into different dairy products.

Determination of milk acidity is a quantitative method of assessing the freshness of the milk.

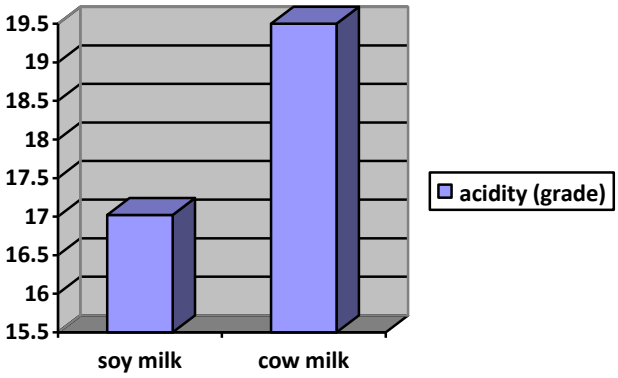

Figure 3. The acidity of the soy milk and cow's milk

The acidity value in the case of soy milk (17.02%) was lower than in the case of cow's milk (19.5%) (figure 3).

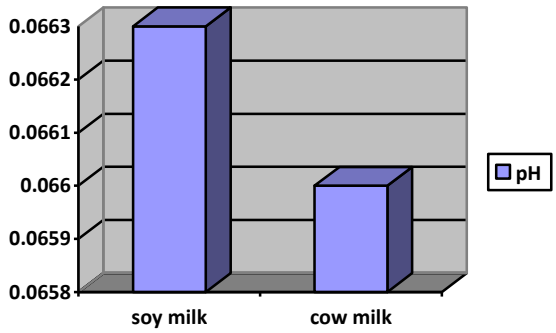

Figure 4. The pH value of the soy milk and cow milk

The pH value of the soy milk was higher (0.0663) than in cows' milk (0.0660), which means that the soybean milk is more alkaline than cow's milk (figure 4).

In conclusion soy milk is more suitable for consumption in case of ulcerous pathology than cow's milk.

CONCLUSIONS

As a result of studies made upon organoleptic and physical-chemical characteristics of soy milk compared to cow's milk, some conclusions can be drawn:

- appearance, consistency and taste of both studied milks revealed no major differences;
- soy milk color was more intense than cow's milk;
- soy milk registered a lower acidity, dry substance and density than those of the cow's milk;
- the pH value of the soy milk was more alkaline than that of cow's milk; soy milk is more suitable for consumption in case of ulcerous pathology than cow's milk.

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