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Comparative Study of the Coagulation Effect of Solanium Nigrum and Ficus Palmata in Yoghurt Production

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Abstract
Coagulation effect of *Solanium nigrum* and *Ficus palmata* in yoghurt production was done between March to June 2015 to assess whether the plants have the potential to coagulate milk or not. The above plants were collected from areas near to Aksum University and they were identified based expert method of plant identification. Different proportions of latexes were taken from those plants based on the specific procedure. The experiment was conducted in Biology laboratory, Aksum University. Data were collected from the treatment and control groups and analyzed by descriptive statistics method. Latex of *Solanium nigruma* has more coagulation effect than *Ficus palmata.* Generally, the above mentioned plants can coagulate milk to yoghurt. According to this research *Solanium nigrum* and *Ficus palmata* are used to change milk to yoghurt but the effect of yoghurt coagulated by the plants on the health of human beings is not known. Therefore, its effect should be conducted.
Keywords: Coagulation, Ficus palamata, Latex, Milk and Solanium nigrum

1. Introduction

1.1. Background of the Study

Yoghurt is one of the numerous products from the processing of milk. Yoghurt is used as a form of preserving essential nutrients in milk is an excellent source of nutrients such as protein, fat, minerals and vitamins. Cheese manufacture is essentially a dehydration process in which the fat and case in of milk is concentrated 6-10 folds (Omotosho *et al*., 2011). Since long the animal rennin (or rennet) is employed in making cheese. The enzyme rennet is obtained on commercial scale from the fourth or true stomach of the unwound calves which are specifically slaughtered for this purpose. One calf produces only 5 to 10gm of rennet. The enzyme helps in coagulating the case in of milk. The milk clotting property of enzyme is important with regard to the quality and yield of cheese.

It has been suggested that a firmer curd at cutting is positively correlated to yield of cheese (Wedholm *et al*., 2006). Much researcher interest how been directed towards discovering a milk-clotting enzyme which would satisfactorily replace calf rennet produced by genetically engineered bacteria have proven suitable substitutes for animal rennet but increasing attention has been directed towards natural rennet extract of plant origin (Mahajan and Badgujar, 2010). Plant proteases employed for yogurt production in various areas of the world includes papin, bromelin, ficin, oryzasin, cucumisin, sodomapple and Jacaratia corumbensis (Duarte *et al.*, 2009).

Naturally (at normal condition) milk need at least one day to be coagulated. But in Ethiopia as well as in Tigray, there are a few plants that can change milk to yoghurt with a short period of time (According to personal communication with the local people of Aksum). Although the local people have indigenous knowledge on the coagulation effect of some plants, there is any scientific research regarding the coagulation effect of those plants.

The Ethiopian people have the habit of drinking yoghurt. Even though there is milk availability in the country, the people cannot get yoghurt when it is needed. Traditionally, in some areas of Ethiopia sheep and goat keepers have used plant parts to change milk to yoghurt. But it is not used to change milk to yoghurt commercially. If it is applied in our day to day activities or commercially, it can satisfy the interest of the people to get yoghurt within a short period of time. There is no scientific evidence presented before regarding the coagulation effect of plant parts (latex). The coagulation effect of plants which are being used to change milk to yoghurt should be assessed scientifically. Therefore, the current study was conducted to assess the coagulation effect of the two plants (*Solanium nigrum and Ficus palmate*) grown near to Aksum town.

2. Methods and materials

2.1. Description of the Study Area

The study was conducted in Biology laboratory, Aksum University. Aksum is located at distance of 1024km far from Addis Ababa. It lies between 14^0N latitude and 38^0 31' E longitudes. The annual average rain fall and temperature of Aksum is 29.7mm and 18.40ºc respectively. According to central statistical agency of Ethiopia (CSA, 2012) the town of Axum's population was 56,576. The census indicated that 30,293 of the population were females and 26,283 were males.

2.2. Sample Collection and Transportation

Milk was collected from the enterprise of Aksum University. After the sample was collected, it was directly transported to Aksum University Biology laboratory and the experiment was done immediately.

Solanium nigrum and *Ficus palmata* were collected from areas near to Aksum University and identified by expert method of plant identification. Fresh parts of the plants with a number of fruits were collected and transported to Aksum University Biology Laboratory when the experiment was conducted.

2.3 Experimental Procedure of the Study

- The fresh raw milk was obtained from the enterprise of Aksum University.
- *Solanium nigrum* and *Ficus palmata* were collected from areas near to Aksum University
- *Treatment groups for Solanium nigrum* and *Ficus palmata were set* in three replications.
- *Control group was also set to compare it with the treatment group*
- 10 ml of raw milk was added to the test tubes for each treatment group
- One, two and three drops of the latex of *Solanium nigrum* and *Ficus palmata* were added (NB: the latex was collected from the fresh fruit of these plant) to the test tubes at room temperature.
- 10 ml of raw milk was added to different test tubes and they were heated at 30, 35 and 40 0^{O}C for ten minutes and cooled for five minutes. Then two and three drops of the latex of *Solanium nigrum* and *Ficus palmata* were added to the test tubes of each replicate of the treatment group.
- Effect of preheating of milk at the same temperature on time of coagulation.

3. Result

3.1. Coagulation Effect of Solanium nigrum and Ficus palmate at room temperature

As the below table indicated us one drop of the latex of *Solanium nigrum* changed 10 ml of raw milk in to yoghurt in 43 minutes but three drops of the plant required less time (33 minutes) than one drops. The different drops of the latex of *Solanium nigrum* needed less time than the different drops of the latex of *Ficus palmata.* One drop of the latex of *Ficus palmata* changed 10 ml of raw milk in to yoghurt in 49 minutes but three drops of the plant required less time (37 minutes) than one drops (**Table 1**).

Table 1: The effect of *Ficus palmata* and *Solanium nigrum* for the coagulation of milk at room temperature

Concentration of milk	Drops of *F.Palmata*	Time	Concentration of milk	Drops of *S.nigrum*	Time
10ml	1	49min	10 ml	1	43min
10 ml	2	42 min	10 ml	2	36 min
10 ml	3	37 min	10 ml	3	33 min
10 ml (control)	0	>24hou	10 ml (control)	0	>24hou

3.2. Coagulation Effect of Solanium nigrum and Ficus palmata at 30^{0}C

As the below table revealed us two drops of the latex of *Solanium nigrum* changed 10 ml of heated raw milk in to yoghurt in 7 minutes but three drops of the plant required less time (4 minutes) than two drops. The different drops of the latex of *Solanium nigrum* needed less time than the different drops of the latex of *Ficus palmata.* Two drops of the latex of *Ficus palmata* changed 10 ml of raw milk in to yoghurt in 14 minutes but three drops of the plant required less time (9 minutes) than two drops (**Table 2**).

Table 2: The coagulation effect of *Ficus palamata* and *Solanium nigrum* at 30^{0}C

Concentration of milk	Drops of *F.Palmata*	Time	Concentration of milk	Drops of *S.nigrum*	Time
10ml	2	14min	10ml	2	7min
10 ml	3	9 min	10 ml	3	4 min
10 ml (control)	0	>12hou	10 ml (control)	0	>12hou

3.3. Coagulation Effect of Solanium nigrum and Ficus palmata at 35^{0}C

As the below table revealed us two drops of the latex of *Solanium nigrum* changed 10 ml of heated raw milk in to yoghurt in 5 minutes but three drops of the plant required less time (3 minutes) than two drops. The different drops of the latex of *Solanium nigrum* needed less time than the different drops of the latex of *Ficus palmata.* two drops of the latex of *Ficus palmata* changed 10 ml of raw milk in to yoghurt in 7 minutes but three drops of the plant required less time (5 minutes) than two drops (**Table 3**).

Table 3: The coagulation effect of *ficus palamata* and *solanium nigrum* at 35^0C

Concentration of milk	Drops of *F.Palmata*	Time	Concentration of milk	Drops of *S.nigrum*	Time
10ml	2	7min	10ml	2	5min
10 ml	3	5min	10 ml	3	3 min
10 ml (control)	0	>12hou	10 ml (control)	0	>12hou

3.4. Coagulation Effect of Solanium nigrum and Ficus palmate at 40^0 C

As the below table revealed us two drops of the latex of *Solanium nigrum* changed 10 ml of heated raw milk in to yoghurt in 2 minutes but three drops of the plant required less time (105 seconds) than two drops. The different drops of the latex of *Solanium nigrum* needed less time than the different drops of the latex of *Ficus palmata.* Two drops of the latex of *Ficus palmata* changed 10 ml of raw milk in to yoghurt in 3 minutes but three drops of the plant required less time (2 minutes) than two drops (**Table** 4).

Table 4: The coagulation effect of *ficus palamata* and *solanium nigrum* at 40^0C

Concentration of milk	Drops of *F.Palmata*	Time	Concentration of milk	Drops of *S.nigrum*	Time
10ml	2	3min	10ml	2	2min
10 ml	3	2 min	10 ml	3	105seco
10 ml (control)	0	>12hou	10 ml (control)	0	>12hou

4. Discussion

As the concentration increases the time needed for the coagulation effect decreases. The result of this study is also related with the research conducted on *Solanium dubium*, the higher the temperature of milk when *Solanium dubium* extract was added the shorter the coagulation time of milk. This result showed that with increasing crude *Solanium dubium* extract concentration, the time of clotting decrease (El Owni et al., 2011). The chemical constituents of different concentration of the latex of those plants may have a positive effect on the coagulation of raw milk to yoghurt.

Solanium nigrum possess the numerous compounds that are responsible for pharmacological activities and it has active compounds such as glycoalkaloids, glycoproteins and poly saccharides (Raviv et al., 2009) and *Ficus palamata* contain flavonoids glycosides, phenolic acid, tannis, conmarins (Kaur, 2012).

As the temperature increases the time needed for the coagulation effect decreases. The milk-clotting time decreased with increase in temperature. The findings are similar to Walde et al (1984) who reported that when temperature decreases, the clotting time of a crude extract of sunflower seed (*Helianthus annus* L) increases. This shows bacteria that are found in the milk are activated or highly initiated for coagulation within the temperature rise.

In the present study the time needed for the coagulation is more compared with the previous study of the coagulation effect of *Solanium dubium* extract. The coagulation time gradually decreased from 51.28±0.08 seconds at 30^0C to 10± 0.00 second at 80^0C. It may be observed that, the higher the temperature of milk when *Solanium dubium* extract is added, the shorter the coagulation time (El Owni et al., 2011). This is due to the chemical constituents that are found in the plants less active than *Solanium dubium*.

5. Conclusion

Solanium nigrum and *Ficus palamata* are used to coagulate milk within a short period of time. As the concentration of the latex of *Solanium nigrum* and *Ficus palamata* increases the time needed for the coagulation effect decreased. Moreover, as the temperature increases the time needed for the coagulation decreased. The coagulation effect of *Solanium nigrum* is more active than Ficus *palmate*. According to this research *Solanium nigrum* and *Ficus palmata* are used to change milk to yoghurt but the effect of yoghurt coagulated by the plants on the health of human beings is not known. Therefore, its effect should be studied.

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