



## Introduction

Eggs are a high nutrition food. It is an important source of protein (12%) vitamin A, B6, B12, folate, amino acids, iron, phosphorus, and selenium. Moreover egg white consider as the most important part which is the main constituents is protein and water, it is also important for the presence of protease inhibitor (Saxena and Tayab., 1997).

Egg white milk (Totu milk) is a functional food produced from hen eggs by separating the egg yolk then homogenizing and concentrating the egg white by enzymatic treatment, it contains 0.1 g/100g carbohydrates, 5.6/100g protein, 0.10 g/100g salt, and free of fat and lactose.

Lactose intolerance is a common disease which causes digestive symptoms after eating or drinking milk or milk product, elimination of milk product without appropriate substitutions, can lead to malnutrition (Lifschitz and Szajewska., 2015).

As a functional food additive probiotics have become a popular approach for managing digestive and immune health, *Lactobacillus* and *Bifidobacterium* are important genera that producing organic acid in the colon, which provides significant benefits on the intestinal tract and creating a healthier gut environment (Topping and Cifton., 2001).

## Aims

- ✓ To select the most promising probiotic *Lactobacillus* and *Bifidobacterium* strains for egg white fermentation.
- ✓ To test the effect of adding different type of sugars (Glucose, Fructose, Saccharose).
- ✓ Determination of cell count and pH changes.

## Methodology

Monoculture fermentation was carried out using Totu milk. The incubation temperature is 37°C for 16-24 hours. During the fermentation, the fermented egg white products will be the subject of a follow-up of the microbiological (the growth of *Lactobacillus* and *Bifidobacterium* strains) and pH value (Sohrabvandi et al.,2012).

## Results and discussion

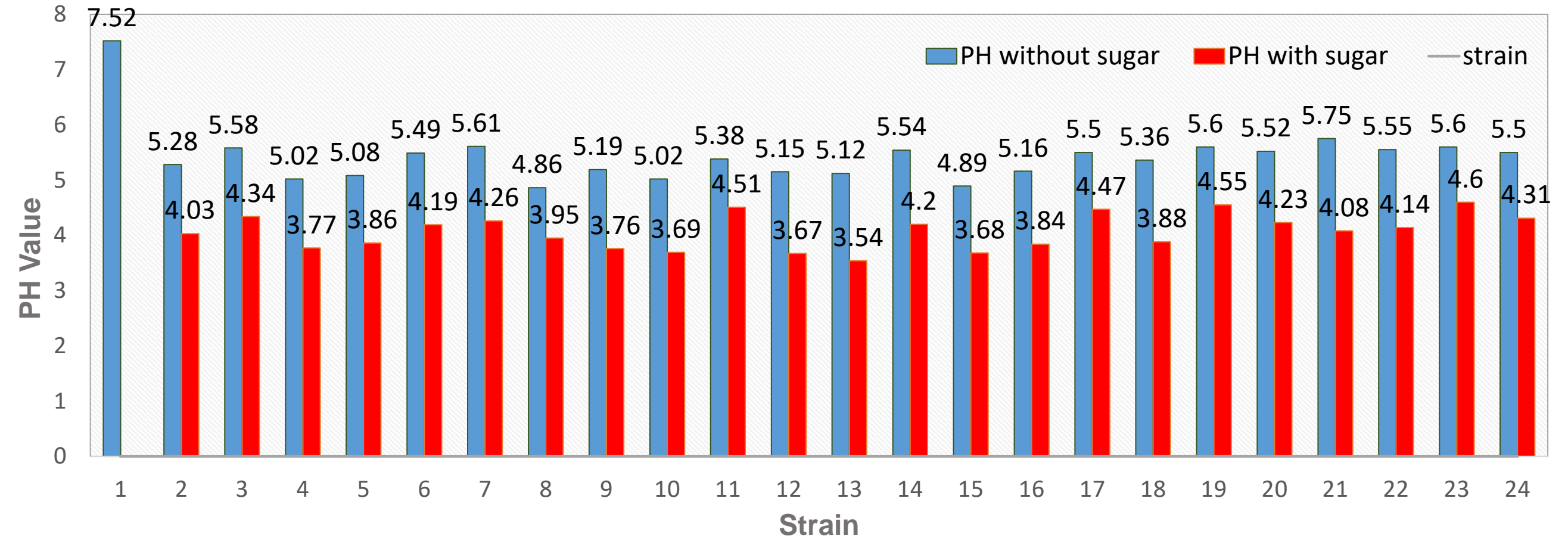
**Figure(1):** displayed the relationship between pH value and the studied strains of *Lactobacillus* and *Bifidobacterium* without/with adding sugar 2% after 24 hours of fermentation. It was perceived that *Bifidobacterium* and *Lactobacillus* were grown in Totu milk with or without sugar added. The pH value ranged 4.89-5.58 and reached pH 6 in case of *Bifidobacterium* strains without sugar added, whereas in case of *L.salivarius* CRL 1328 and *B.longum* Rosell-175 strains the pH value significantly decreased in egg white with 2% sugar) compared to other *Lactobacillus* and *Bifidobacterium* strains respectively.

**Figure(2):** demonstrated that the cell count of *L. acidophilus* 150 was increasing significantly during fermentation time from 8 to 24 hours (pH=3.84). It was also observed that *L.plantarum* 299V, *L.rhamnosus* Rosell-11, *L.salivarius* CRL1328 decreased the pH value dramatically after 8 hours of fermentation compared to the other studied strains its reach to pH 5.71, 5.72, 5.60 respectively. *L.helveticus* R-52, *L. rhamnosus* Rosell-11, *L.salivarius* CRL 1328 showed an increase in pH value after 20 hours of fermentation with no significant difference between cell count after 20 hours and after 24 hours, therefore the needed fermentation time of these three strains is 20 hours. The best strain after 20 hours of fermentation was *L.rhamnosus* Rosell-11 which has the highest growth rate log CFU/mL =9, and the lowest pH value=3.73. The strain which has the highest growth rate value after 24 hours of fermentation was *L.plantarum* 299V log CFU/mL =9.26 with the same pH value.**Figure(3):** highlights that the decrease rate of PH value in samples included *Bifidobacterium* strains was lower than samples incubated with *Lactobacillus*, it was also observed that *B.longum* Bb46 reached to pH value of 4.2 after 20 hours of fermentation while *B.longum* DSM reached 4.31 after 24 hours of fermentation.

**Figure(4):** indicates to the specific growth rate of *Lactobacillus* and *Bifidobacterium* strains during fermentation. *L.plantarum* 299 V recorded the highest specific growth rate value compared to *Lactobacillus* strains, *B.longum* Bb46 was also higher than *B.longum* DSM 16603.

**Table (1):** demonstrated the relationship between pH and cell count in samples which was inoculated with *L.plantarum* 299V using different types of sugar 2%. It was observed that there are no significant differences between using glucose, saccharose, fructose on the pH value and total cell count. The cell count was higher than 10<sup>8</sup> CFU/ml.

Fig (1): The pH of egg white after 24 hours of fermentation



1- initial pH of Totu milk 2- *L. brevis* HA-112, 3- *L. fermentum* HA-179,4- *L. helveticus* Lafti<sup>®</sup>L10, 5- *L. helveticus* R-52 6- *L. plantarum* HA-119, 7- *L.reuteri* HA-188,8- *L. rhamnosus* HA-111,9- *L. rhamnosus* Rosell-11,10- *L.salivarius* HA-118, 11- *L. crispatus* LCRO1, 12- *L. rhamnosus* GG ATCC53103,13- *L. salivarius* CRL 1328, 14- *L. fermentum* LF08,15- *L. plantarum* 299V,16- *L. casei* 01, 17- *L. acidophilus* La-5,18- *L. acidophilus* 150 ,19- *B. bifidum* Rosell-71, 20- *B. Lafti<sup>®</sup>B94*, 21- *B. longum* Rosell-175, 22- *B. longum* Bb46, 23- *B. lactis* Bb12,24-*B. longum* DSM 16603.

Fig (2):The changes in pH and growth rate during fermentation time of *Lactobacillus* strains

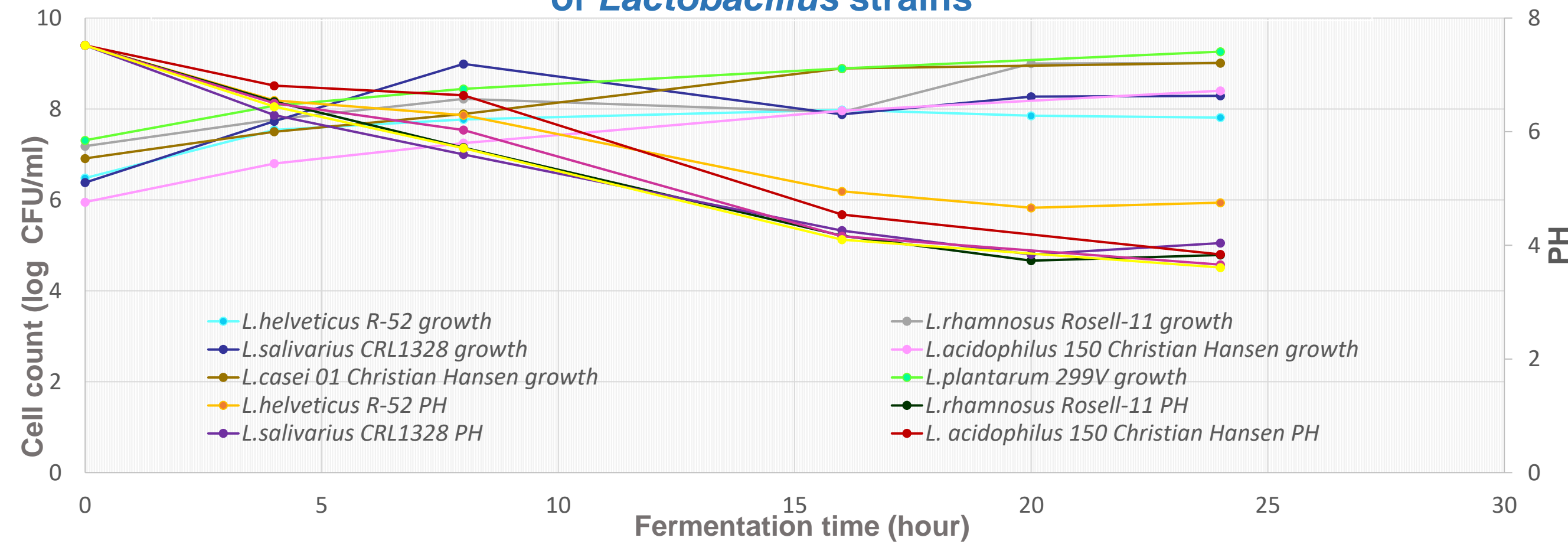


Fig (3): The relationship between pH, time and log10 of *Bifidobacterium* strains

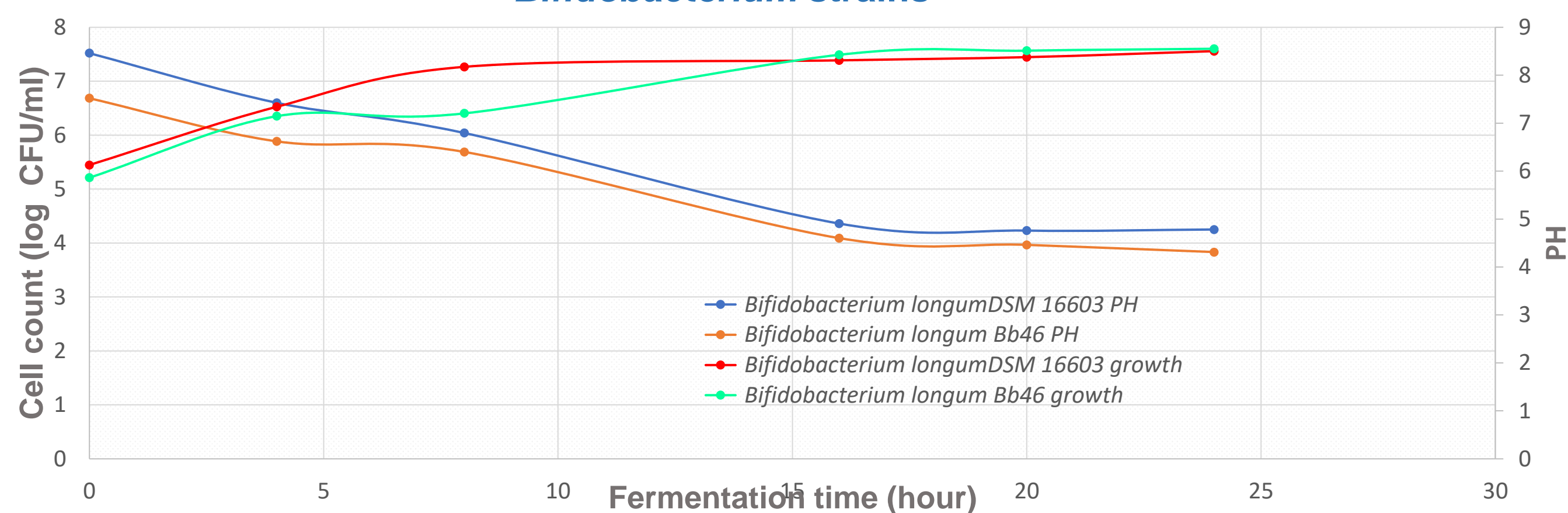


Fig (4): Specific growth rates of *Lactobacillus* and *Bifidobacterium* strains

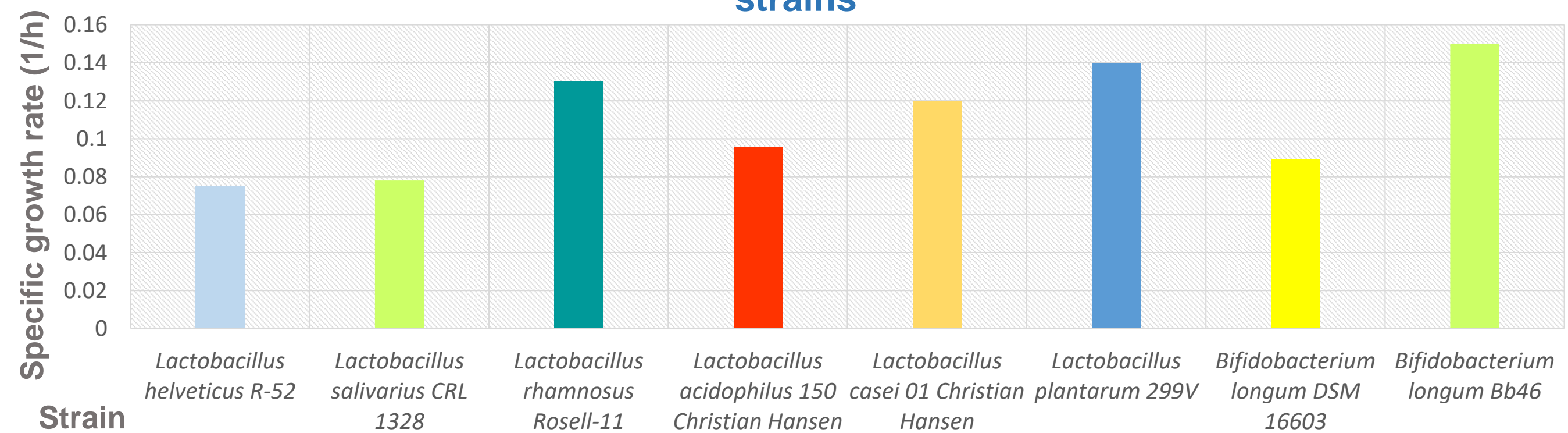


Table (1): The relationship between pH and cell count by using different type of sugar

Sugar type	Average pH value after 24 hours	Average total count after 24 hours (CFU/ml)
Without sugar	5.98	1.60*10 <sup>8</sup>
Glucose	4.16	3.94*10 <sup>8</sup>
Saccharose	4.42	2.95*10 <sup>8</sup>
Fructose	4.16	4.11*10 <sup>8</sup>

## Conclusion

Fermented Totu milk is an appropriate alternative product for people whose suffering from lactose intolerance and milk protein allergy, eggwhite is also an important source of protein besides the significant role of probiotic bacteria with health promoting effects.

## References

- ✦ Lifschitz, C., and Szajewska, H., (2014) 'Cow's Milk Allergy: Evidence-Based Diagnosis and Management for the Practitioner'. *European Journal of Pediatrics* 174.
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