

# **NOVEL NON-DAIRY YOGHURT FROM PIGEON PEA MILK**

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# INTRODUCTION

- **Pigeon pea (*Cajanus cajan*): under researched, under utilized, drought tolerant (Naylor et al. 2004)**
- **Nutrient profile**
  - **Protein (20 to 32%)**
  - **Carbohydrate (49 to 60%)(Saxena et al. 2008),**
  - **Lysine of pigeon pea (7.79) is superior to that of soya (6.1) (Akande et al. 2010; Sigh 1999)**
- **Utilization**
  - **Traditional medicine**
  - **Culinary use**
  - **Other uses**



**Fig 1: Pigeon pea grains**



**Fig 2: Soy bean grains**

**Table 1 :Amino acid composition of some legumes protein<sup>1</sup>**

<b>Legume type</b>	<b>ASP</b>	<b>GLU</b>	<b>LYS</b>	<b>HIS</b>	<b>ILE</b>	<b>LEU</b>	<b>MET</b>	<b>VAL</b>
<b>Pigeon pea<sup>b</sup></b>	<b>11.56</b>	<b>9.23</b>	<b>7.79</b>	<b>3.66</b>	<b>3.47</b>	<b>6.78</b>	<b>1.19</b>	<b>5.85</b>
<b>Bambara groundnut<sup>a</sup></b>	<b>9.6</b>	<b>15.4</b>	<b>6.3</b>	<b>3.0</b>	<b>3.8</b>	<b>7.3</b>	<b>1.8</b>	<b>4.3</b>
<b>Soya bean <sup>f</sup></b>	<b>11.4</b>	<b>16.9</b>	<b>6.1</b>	<b>2.5</b>	<b>4.6</b>	<b>7.7</b>	<b>1.2</b>	<b>4.6</b>
<b>Peanut <sup>g</sup></b>	<b>12.1</b>	<b>21.1</b>	<b>3.8</b>	<b>2.5</b>	<b>3.5</b>	<b>7.0</b>	<b>1.3</b>	<b>3.9</b>
<b>Cowpea <sup>e</sup></b>	<b>12.2</b>	<b>18.9</b>	<b>6.9</b>	<b>2.5</b>	<b>4.6</b>	<b>7.7</b>	<b>1.2</b>	<b>5.4</b>
<b>FAO/WHO</b>			<b>5.8</b>	<b>1.9</b>	<b>2.8</b>	<b>6.6</b>	<b>1.7</b>	<b>3.5</b>

# **NON DAIRY YOGHURTS**

- **Yoghurt : Fermented semi fluid milk product (Falade et al. 2014).**
- **Types**
- **Limitations of dairy yoghurt**
- **Non dairy yoghurt**
  - **Soy**
  - **Bambara**
  - **Corn**

# **PREVIOUS RESEARCH ON NON DAIRY YOGHURTS**

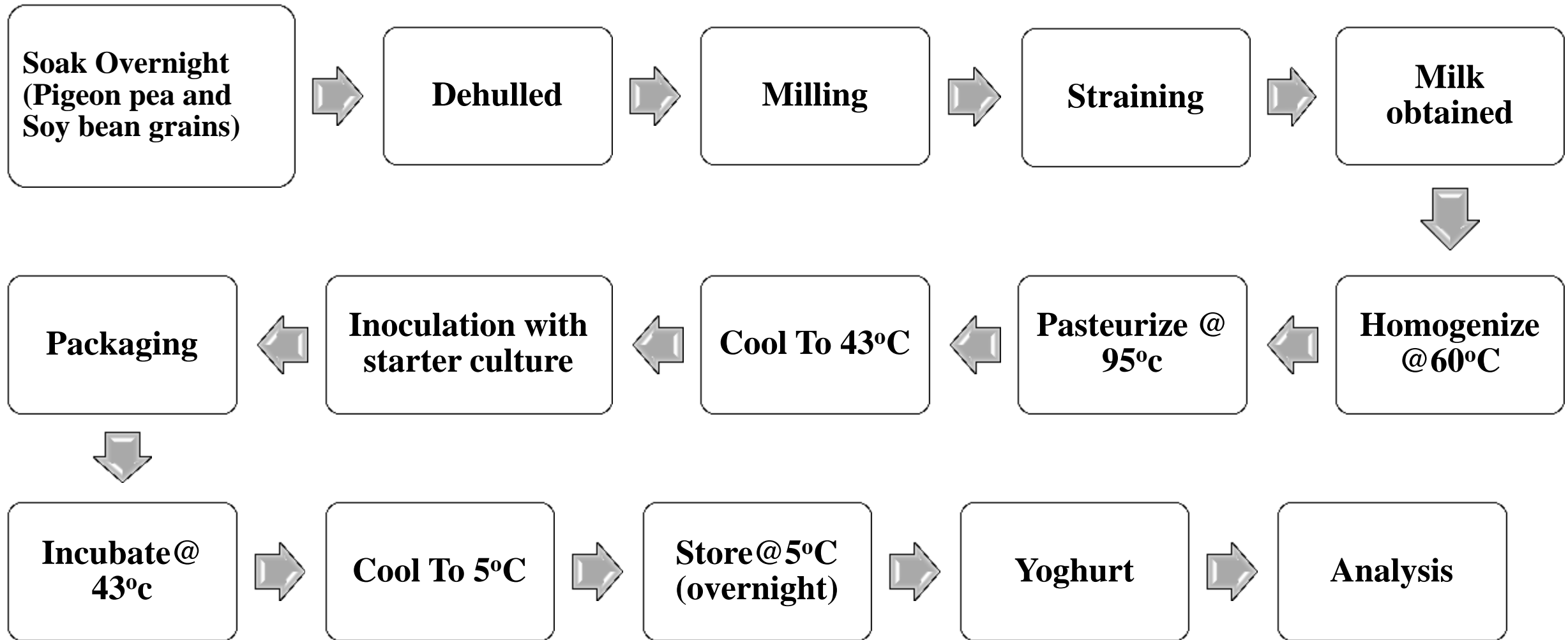
- **Bambara yoghurt was reported to have better sensory properties than soy yoghurt (Falade et al. 2014)**
- **Variation in total solids with temperature was reported for both bambara and soy yoghurts**
- **Lactic acid bacteria were reported to be the predominant organisms in yoghurt samples**

# **Aim**

**To develop and investigate quality attributes of Pigeon pea based yoghurt.**

## **OBJECTIVES**

- To determine the proximate composition of yoghurt samples.**
- To determine storage stability, pH and titratable acidity of yoghurt.**
- To determine the consumer acceptability of yoghurt .**



- Fig 3: Flow chart of yoghurt production
- Modified method (Tammime and Robinson 1999)

- **PRODUCTS**
- 50% pigeon pea + 50% soya milk
- 100% pigeon pea
- 100% soya milk

- **ANALYSIS**
- Proximate
- Storability
- Consumer acceptability



Fig 4a: Raw pigeon pea milk



Fig 4b: Pasteurisation of milk in progress



Fig 4c: Yoghurt during incubation



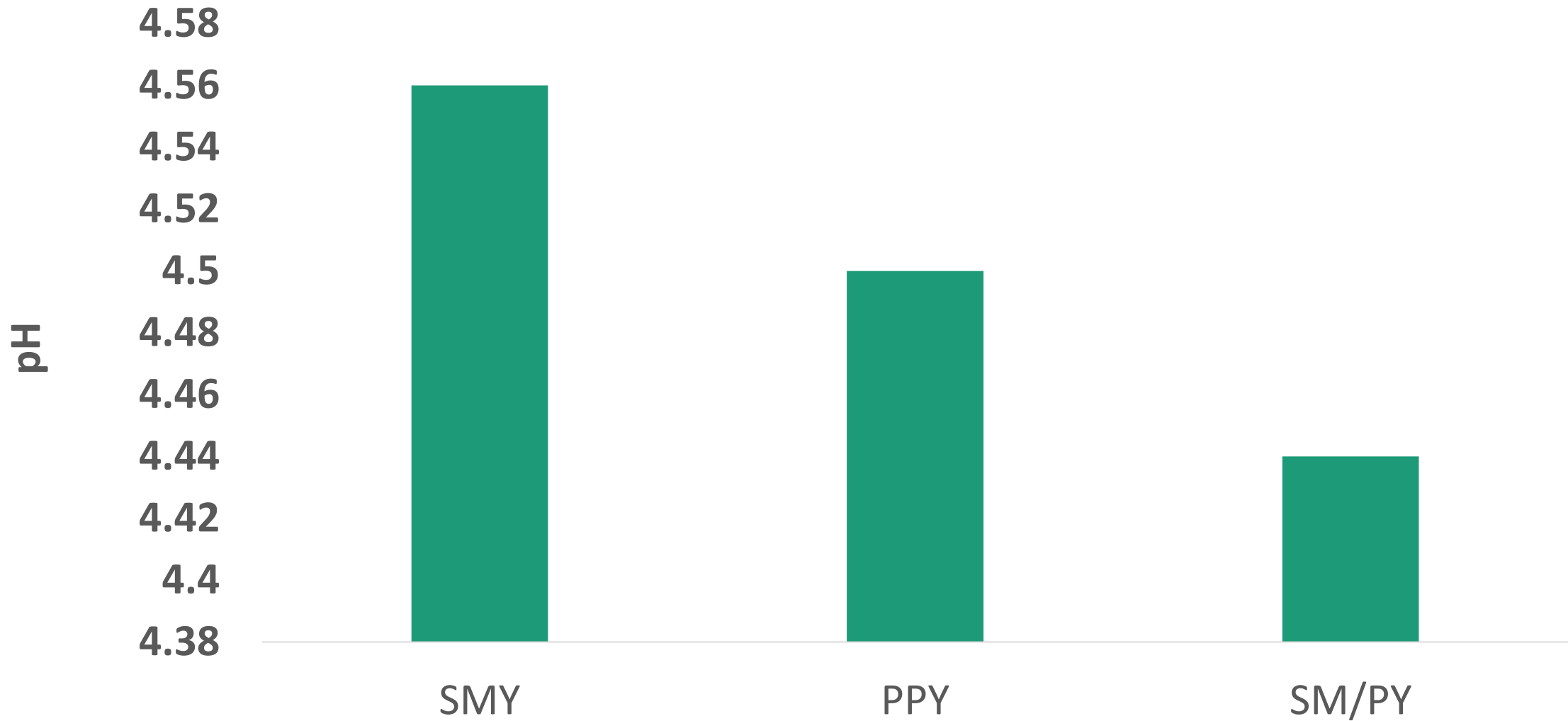
Fig 4d: Yoghurt samples: SM/PY, SMY & PPYP.



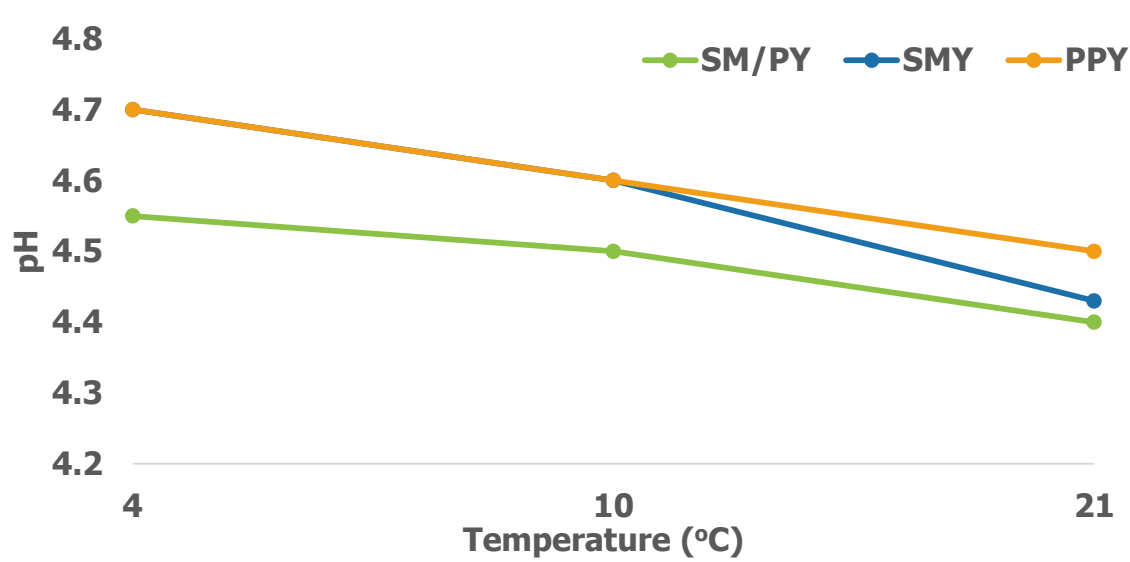
# RESULTS AND DISCUSSION

**Table 2: Proximate composition for milk and yoghurt produced from pigeon pea and soya milk**

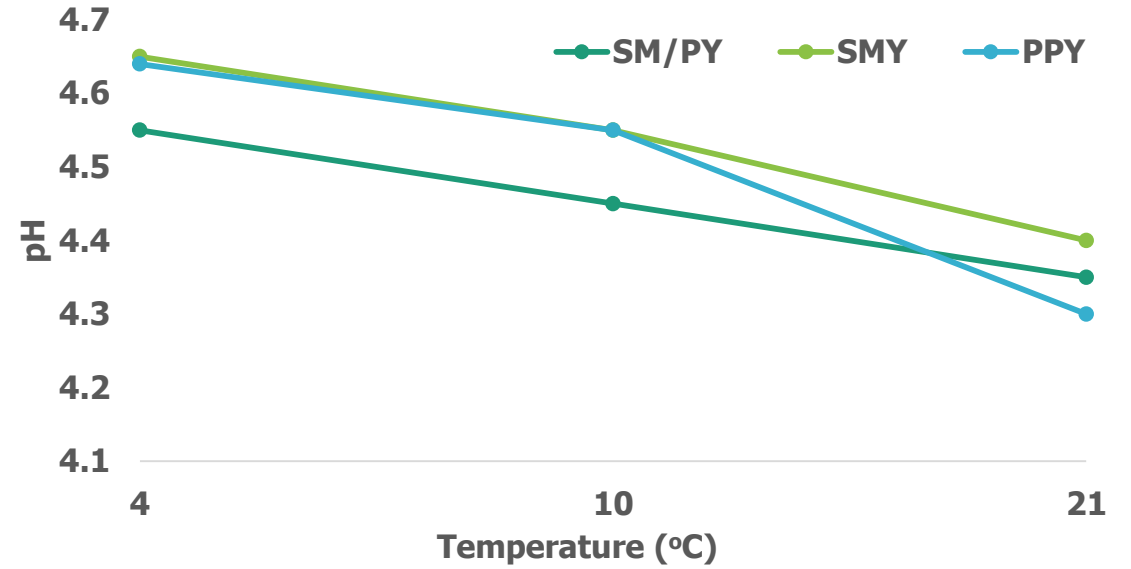
<b>Samples</b>	<b>Total solid</b>	<b>Solid-non-fat</b>	<b>Moisture</b>	<b>Crude fat</b>	<b>Crude protein</b>	<b>Ash</b>	<b>Carbohydrate</b>
<b>Soymilk</b>	<b>15.0 ± 0.16<sup>a</sup></b>	<b>13.03 ± 0.97<sup>a</sup></b>	<b>84.9 ± 0.16<sup>a</sup></b>	<b>2.00 ± 0.04<sup>a</sup></b>	<b>9.3 ± 0.50<sup>a</sup></b>	<b>0.65 ± 0.00<sup>bc</sup></b>	<b>0.52 ± 0.00<sup>a</sup></b>
<b>Pigeon pea milk</b>	<b>12.54 ± 0.25<sup>b</sup></b>	<b>12.20 ± 0.57<sup>a</sup></b>	<b>87.46 ± 0.25<sup>a</sup></b>	<b>0.56 ± 0.00<sup>a</sup></b>	<b>7.49 ± 0.63<sup>a,b</sup></b>	<b>0.58 ± 0.08<sup>b</sup></b>	<b>3.70 ± 1.70<sup>b</sup></b>
<b>Soymilk yoghurt</b>	<b>18.29 ± 0.00<sup>c</sup></b>	<b>16.13 ± 0.23<sup>b</sup></b>	<b>81.71 ± 0.00<sup>a</sup></b>	<b>1.99 ± 0.24<sup>b</sup></b>	<b>4.54 ± 0.05<sup>ab</sup></b>	<b>1.03 ± 0.00<sup>c</sup></b>	<b>10.74 ± 0.19<sup>c</sup></b>
<b>Soy/pigeon pea milk yoghurt</b>	<b>18.43 ± 0.37<sup>d</sup></b>	<b>17.41 ± 0.66<sup>b</sup></b>	<b>81.83 ± 0.09<sup>a</sup></b>	<b>0.76 ± 0.67<sup>cd</sup></b>	<b>5.00 ± 0.00<sup>ab</sup></b>	<b>0.72 ± 0.01<sup>c</sup></b>	<b>11.70 ± 0.69<sup>cd</sup></b>
<b>Pigeon pea milk yoghurt</b>	<b>18.17 ± 0.00<sup>d</sup></b>	<b>16.92 ± 0.18<sup>b</sup></b>	<b>81.83 ± 0.00<sup>c</sup></b>	<b>1.25 ± 0.18<sup>de</sup></b>	<b>5.02 ± 0.04<sup>c</sup></b>	<b>0.61 ± 0.00<sup>b</sup></b>	<b>11.26 ± 0.18<sup>cd</sup></b>



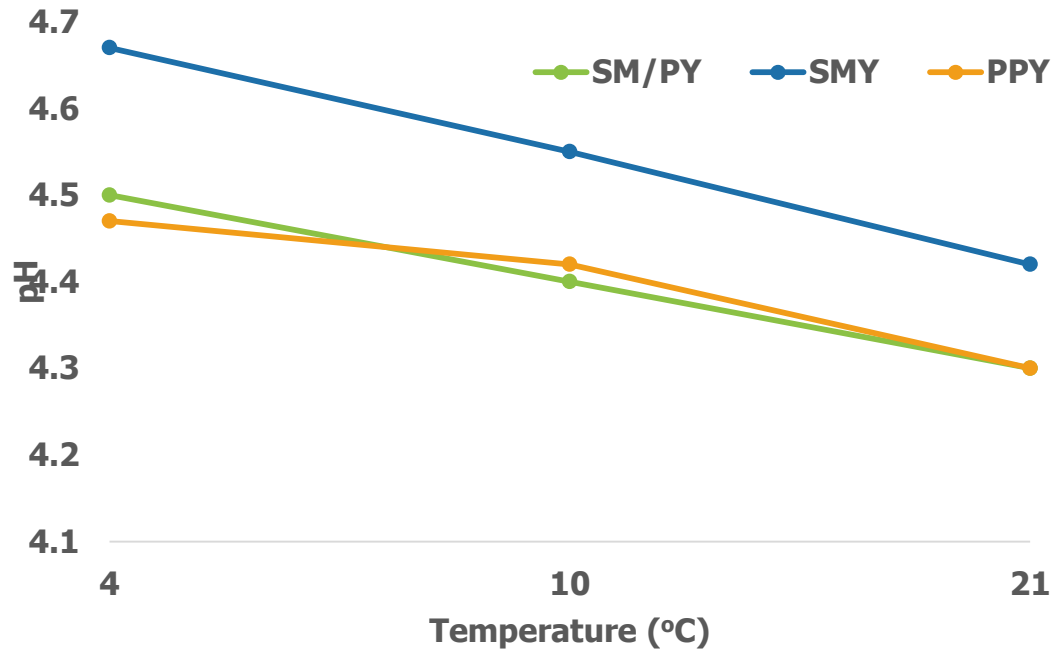
**Fig. 5 : Termination pH of yoghurt samples**



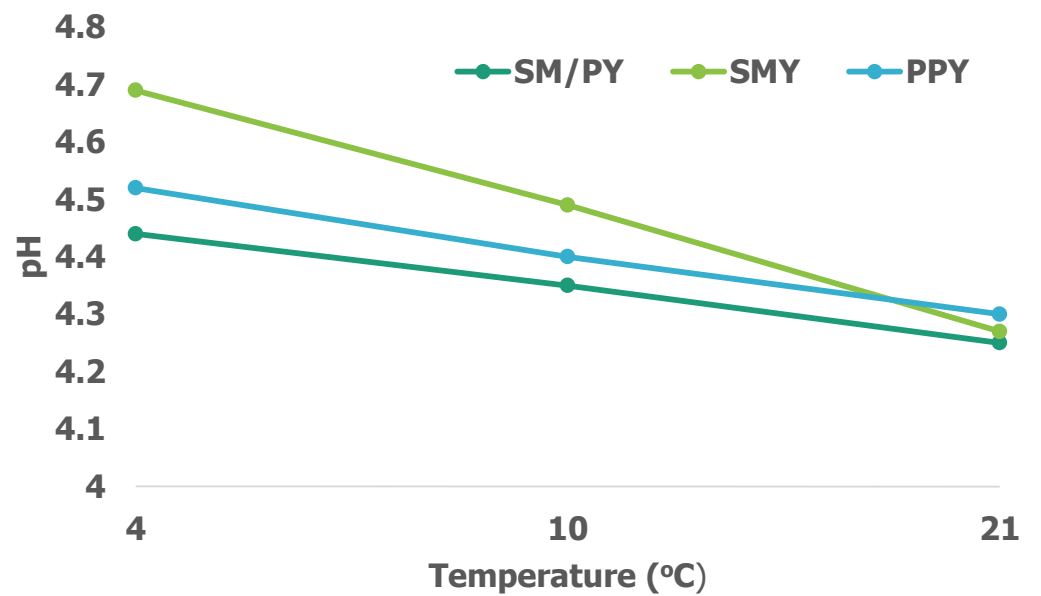
**Fig 6a: pH of yoghurt samples – week 1**



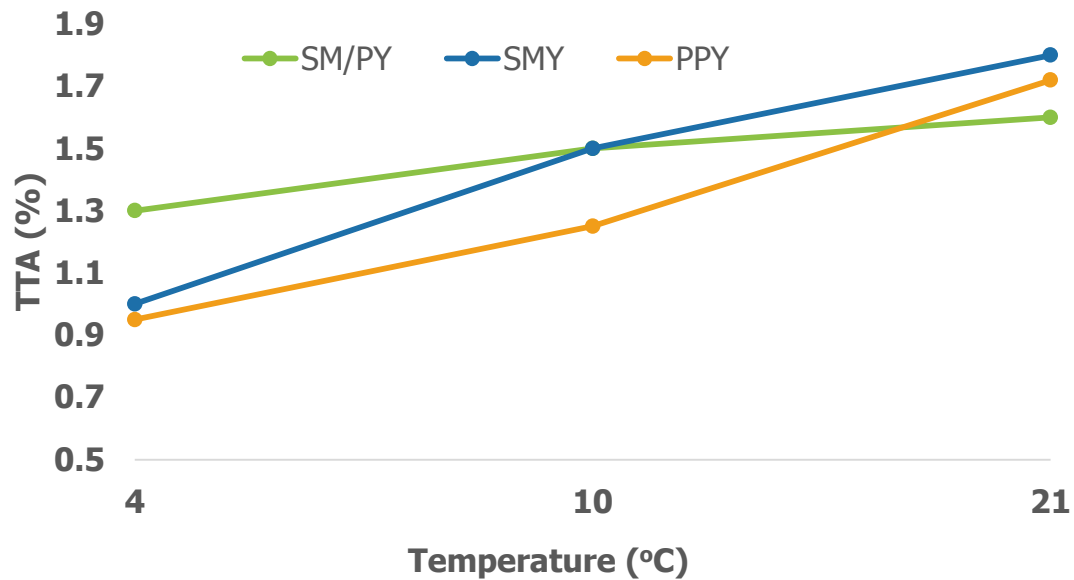
**Fig 6b: pH of yoghurt samples - week 2**



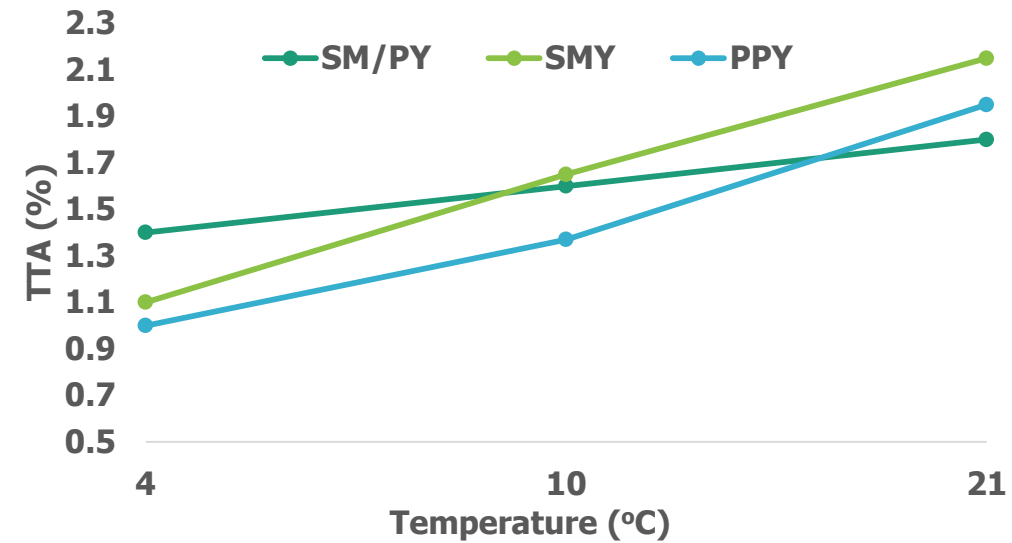
**Fig 6c: pH of yoghurt samples - week 3**



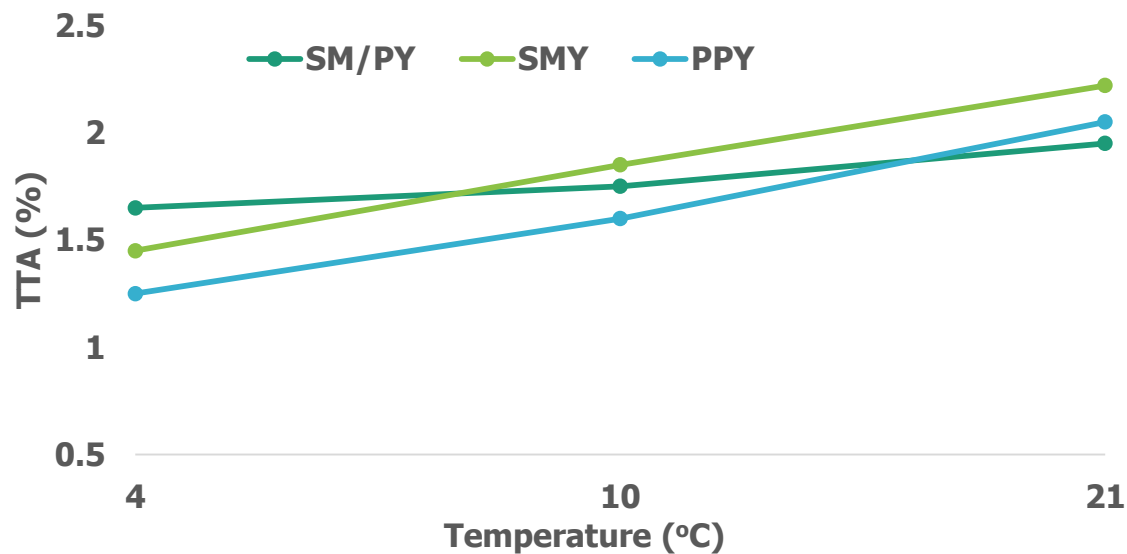
**Fig 6d: pH of yoghurt samples - week 4**



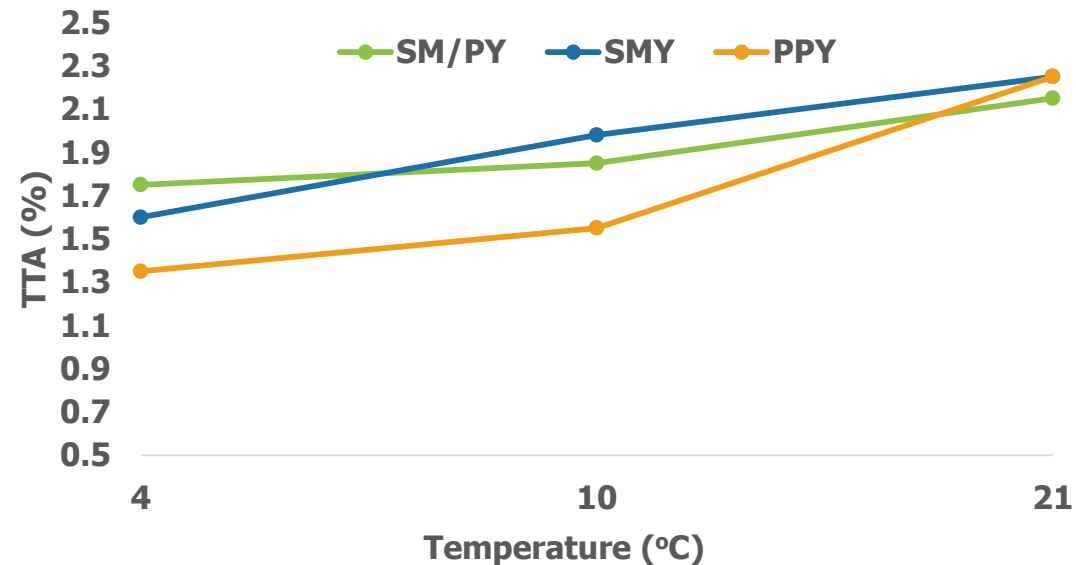
**Fig 7a: TTA of yoghurt samples - week 1**



**Fig 7b: TTA of yoghurt samples - week 2**



**Fig 7c: TTA of yoghurt samples - week 3**



**Fig 7d: TTA of yoghurt samples - week 4**

Table 3a: Storage stability of yoghurt samples at 4, 10 and 21°C.

	<b>WEEK 1</b>	<b>(4°C) log (cfu/ml)</b>			
<b>Products</b>	<b>Mould</b>	<b>Total plate count</b>	<b>Lactic acid bacteria</b>	<b>E.coli</b>	<b>Aerobic spore former</b>
<b>SMPY</b>	<b>ND</b>	<b>7.39</b>	<b>7.51</b>	<b>ND</b>	<b>ND</b>
<b>SMY</b>	<b>ND</b>	<b>7.01</b>	<b>7.31</b>	<b>ND</b>	<b>ND</b>
<b>PPY</b>	<b>ND</b>	<b>7.22</b>	<b>7.36</b>	<b>ND</b>	<b>ND</b>
		<b>(10°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>ND</b>	<b>8.85</b>	<b>8.72</b>	<b>ND</b>	<b>ND</b>
<b>SMY</b>	<b>ND</b>	<b>8.77</b>	<b>8.75</b>	<b>ND</b>	<b>ND</b>
<b>PPY</b>	<b>ND</b>	<b>8.59</b>	<b>8.57</b>	<b>ND</b>	<b>ND</b>
		<b>(21°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>ND</b>	<b>8.89</b>	<b>8.79</b>	<b>ND</b>	<b>ND</b>
<b>SMY</b>	<b>ND</b>	<b>8.75</b>	<b>8.66</b>	<b>ND</b>	<b>ND</b>
<b>PPY</b>	<b>ND</b>	<b>8.76</b>	<b>8.76</b>	<b>ND</b>	<b>ND</b>

Where: **SM/PY**: 50 % soymilk + 50 % pigeon pea milk yoghurt, **SMY**: Soymilk yoghurt, **PPY**: Pigeon pea milk yoghurt, ND: not detected.

**Table 3b**

	<b>WEEK 2</b>	<b>(4°C) log (cfu/ml)</b>			
<b>Products</b>	<b>Mould</b>	<b>Total plate count</b>	<b>Lactic acid bacteria</b>	<b>E.coli</b>	<b>Aerobic spore former</b>
<b>SMPY</b>	<b>0.79</b>	<b>7.39</b>	<b>7.51</b>	<b>ND</b>	<b>ND</b>
<b>SMY</b>	<b>0.88</b>	<b>7.01</b>	<b>7.31</b>	<b>ND</b>	<b>ND</b>
<b>PPY</b>	<b>0.92</b>	<b>7.22</b>	<b>7.36</b>	<b>ND</b>	<b>ND</b>
		<b>(10°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>1.13</b>	<b>8.88</b>	<b>8.91</b>	<b>ND</b>	<b>ND</b>
<b>SMY</b>	<b>1.11</b>	<b>8.79</b>	<b>8.63</b>	<b>ND</b>	<b>ND</b>
<b>PPY</b>	<b>1.07</b>	<b>8.66</b>	<b>8.72</b>	<b>ND</b>	<b>ND</b>
		<b>(21°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>1.23</b>	<b>8.88</b>	<b>8.77</b>	<b>ND</b>	<b>ND</b>
<b>SMY</b>	<b>1.15</b>	<b>8.89</b>	<b>8.81</b>	<b>ND</b>	<b>ND</b>
<b>PPY</b>	<b>1.11</b>	<b>8.85</b>	<b>8.62</b>	<b>ND</b>	<b>ND</b>

Where: **SM/PY**: 50 % soymilk + 50 % pigeon pea milk yoghurt, **SMY**: Soymilk yoghurt, **PPY**: Pigeon pea milk yoghurt, **ND**: not detected.

**Table 3c**

	<b>WEEK 3</b>	<b>(4°C ) log/cfu</b>			
<b>Products</b>	<b>Mould</b>	<b>Total plate count</b>	<b>Lactic acid bacteria</b>	<b>E.coli</b>	<b>Aerobic spore former</b>
<b>SMPY</b>	<b>1.21</b>	<b>6.84</b>	<b>6.94</b>	<b>ND</b>	<b>0.85</b>
<b>SMY</b>	<b>1.13</b>	<b>6.57</b>	<b>6.83</b>	<b>ND</b>	<b>0.80</b>
<b>PPY</b>	<b>1.05</b>	<b>6.83</b>	<b>6.79</b>	<b>ND</b>	<b>0.85</b>
		<b>(10°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>1.33</b>	<b>6.86</b>	<b>6.92</b>	<b>ND</b>	<b>1.0</b>
<b>SMY</b>	<b>1.37</b>	<b>6.81</b>	<b>6.92</b>	<b>ND</b>	<b>0.95</b>
<b>PPY</b>	<b>1.29</b>	<b>6.92</b>	<b>6.88</b>	<b>ND</b>	<b>0.95</b>
		<b>(25°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>1.35</b>	<b>6.85</b>	<b>6.87</b>	<b>ND</b>	<b>1.2</b>
<b>SMY</b>	<b>1.39</b>	<b>6.91</b>	<b>6.88</b>	<b>ND</b>	<b>1.2</b>
<b>PPY</b>	<b>1.32</b>	<b>6.86</b>	<b>6.88</b>	<b>ND</b>	<b>1.2</b>

Where: **SM/PY**: 50 % soymilk + 50 % pigeon pea milk yoghurt, **SMY**: Soymilk yoghurt, **PPY**: Pigeon pea milk yoghurt, ND: not detected.

**Table 3d**

	<b>WEEK 4</b>	<b>(4°C) log (cfu/ml)</b>			
<b>Products</b>	<b>Mould</b>	<b>Total plate count</b>	<b>Lactic acid bacteria</b>	<b>E.coli</b>	<b>Aerobic spore former</b>
<b>SMPY</b>	<b>1.60</b>	<b>6.83</b>	<b>6.92</b>	<b>ND</b>	<b>1.2</b>
<b>SMY</b>	<b>1.66</b>	<b>6.53</b>	<b>6.83</b>	<b>ND</b>	<b>1.2</b>
<b>PPY</b>	<b>1.62</b>	<b>6.80</b>	<b>6.73</b>	<b>ND</b>	<b>1.2</b>
		<b>(10°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>1.66</b>	<b>6.81</b>	<b>6.92</b>	<b>ND</b>	<b>1.4</b>
<b>SMY</b>	<b>1.69</b>	<b>6.81</b>	<b>6.92</b>	<b>ND</b>	<b>1.5</b>
<b>PPY</b>	<b>1.69</b>	<b>6.90</b>	<b>6.83</b>	<b>ND</b>	<b>1.5</b>
		<b>(25°C) log (cfu/ml)</b>			
<b>SMPY</b>	<b>1.87</b>	<b>6.85</b>	<b>6.87</b>	<b>ND</b>	<b>1.8</b>
<b>SMY</b>	<b>1.73</b>	<b>6.71</b>	<b>6.82</b>	<b>ND</b>	<b>1.9</b>
<b>PPY</b>	<b>1.75</b>	<b>6.76</b>	<b>6.87</b>	<b>ND</b>	<b>1.9</b>

Where: **SM/PY**: 50 % soymilk + 50 % pigeon pea milk yoghurt, **SMY**: Soymilk yoghurt, **PPY**: Pigeon pea milk yoghurt, ND: not detected.



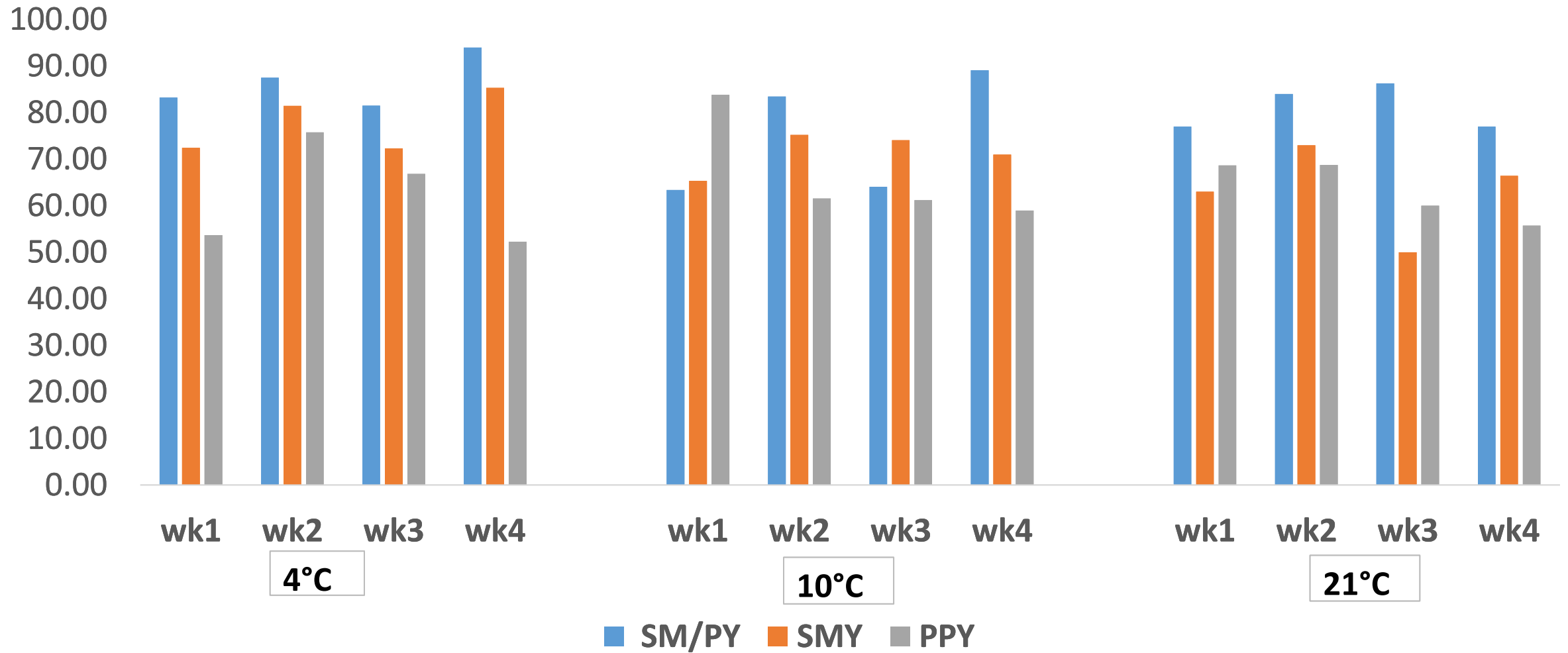
## Table 4: Consumer Acceptability Test

Sample	Colour	Aroma	Taste	Mouth feel	Overall acceptability
SMY	6.82 ± 1.8 <sup>a,b</sup>	6.29 ± 2.0 <sup>a</sup>	6.12 ± 2.4 <sup>a</sup>	6.67 ± 2.0 <sup>a</sup>	6.80 ± 2.1 <sup>b</sup>
PPY	7.27 ± 1.4 <sup>b</sup>	6.35 ± 1.6 <sup>a</sup>	5.76 ± 1.9 <sup>a</sup>	6.88 ± 1.3 <sup>a</sup>	6.49 ± 1.7 <sup>a,b</sup>
SM/PY	6.10 ± 2.7 <sup>a</sup>	6.08 ± 2.4 <sup>a</sup>	6.08 ± 2.3 <sup>a</sup>	6.60 ± 1.8 <sup>a</sup>	6.54 ± 2.3 <sup>a,b</sup>

**Means values followed by different superscript letters are significantly different.**

**Where: SM/PY: 50 % soymilk + 50 % pigeon pea milk yoghurt, SMY: Soymilk yoghurt, PPY: Pigeon pea milk yoghurt, ND: not detected.**

## Water holding capacity of yoghurt samples



**Fig 8: Water holding capacity of yoghurt samples stored at 4 10 and 21oC for 4 weeks**

## Conclusion

- **Acceptable yoghurt was produced from pigeon pea with comparable quality to soy which serve as control.**
- **Proximate composition was comparable to previous reports. Microbial quality and profile of all the yoghurt samples were similar.**
- **The absence of pathogenic bacteria in all the yoghurt samples confirm their safety.**
- **Soy yoghurt was most acceptable among the yoghurt samples but all the samples had comparable ratings, and these ratings are within commercially acceptable range ( 4 to 9) for yoghurt.**
- **Storage at 4°C should be the most acceptable, as storage at 21°C encourage proliferation of contaminants.**

*THANK YOU FOR LISTENING*