Glycation of isolated muscle proteins with glucosamine: Impact on functionality

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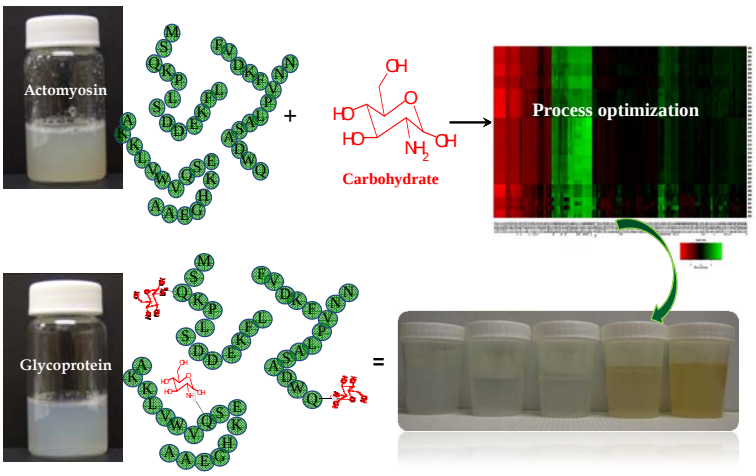
BACKGROUND

- The technological properties of proteins depend on their functionality;
- Protein-sugar complexes produced by the Maillard reaction in dry conditions have been proven to improve functionality of the proteins at the laboratory level;
- However, this conjugation technique has not been extensively applied in industrial-scale processing;
- Long reaction time and formation of reaction side products are among the main drawbacks of protein glycation in dry conditions;
- Protein-sugar conjugation in liquid conditions and at moderate temperatures could be an alternative method to upgrade protein functionality;
- Higher reactivity of the amino sugar glucosamine (**GlcN**) towards glycation could be used to catalyze reaction rates at ambient temperatures.

OBJECTIVES

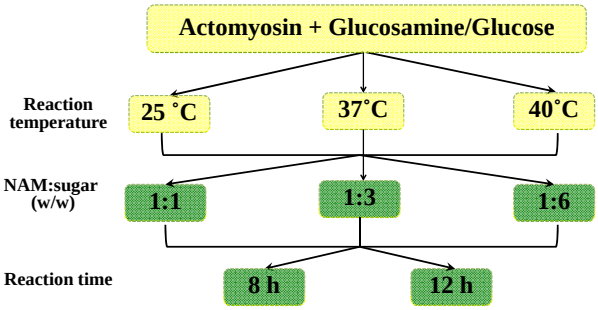
- Demonstrate the possibility of natural actomyosin (**NAM**) glycation with GlcN by the Maillard reaction in a liquid medium at moderate temperatures;
- Examine the impact of GlcN conjugation to isolated NAM complex on protein functionality.

OUR APPROACH



- Isolated actomyosin was mixed with glucosamine or glucose;
- Obtained aliquots were incubated for 8 or hours at different temperatures;
- Glycoconjugates against control (non-treated protein) were tested for functionality.

EXPERIMENTAL DESIGN



OUR OBSERVATIONS

Proof of conjugation by mass spectrometry

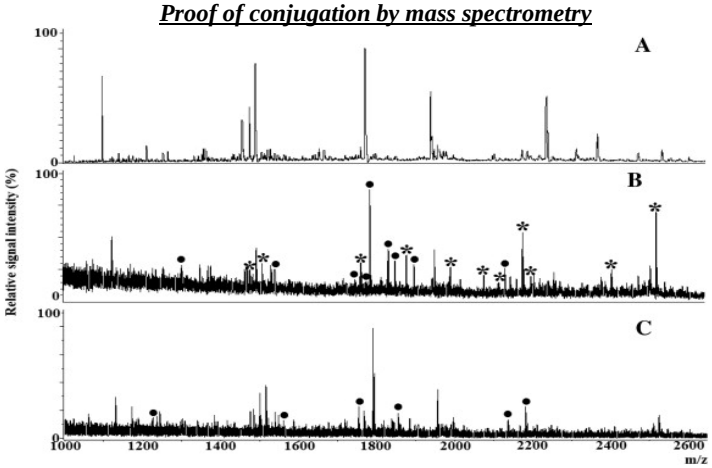


Figure 1. MALDI-TOF/TOF mass spectra of non-treated actomyosin (A), and actomyosin conjugated with glucosamine (B) or glucose (C) at 40 ° C for 8 h. The filled circle refers to M_w obtained from glycation with glucosamine or glucose, respectively. The stars indicated M_w obtained from glycation with glucosamine considering NH_3 release.

- On average, 32% of the total peptides were glycated with glucosamine;
- Around 14% of NAM peptides were glycated with glucose.

Impact of glycation on protein solubility

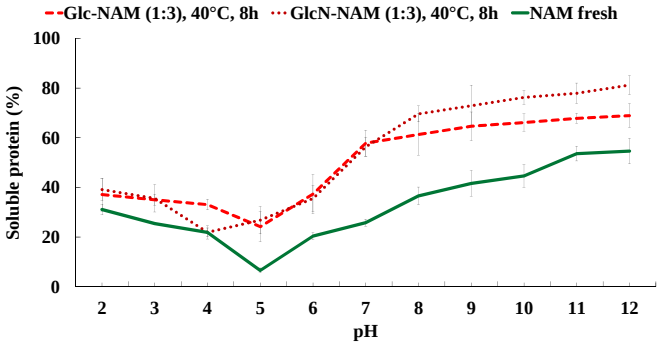


Figure 2. Solubility of actomyosin as dependent on pH and type of sugar.

- The solubility of NAM glycated with glucosamine was higher than those glycated with glucose;
- Actomyosin solubility increased on 23% by conjugation with glucosamine;

CONCLUSIONS

- Glycation significantly improves protein functionalities;
- Glycation with glucosamine is more efficient as compared to glucose.

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