EFFECT OF HUMAN SALIVA ON THE CONSISTENCY OF THICKENED FOODS FOR PATIENTS WITH DYSPHAGIA

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INTRODUCTION

Dysphagia is defined as the difficulty or inability to swallow. Dysphagia can occur at any age as a consequence of different types of illness or injury resulting in mechanical or neurological impairment of the swallowing process. Texture modified diets are commonly prescribed for patients with swallowing disorders. To increase the viscosity of foods/drinks, starch-based thickeners (ST) are commonly used. These are highly sensitive to α-amylase in saliva, leading to a potential thin and unsafe fluid consistency during consumption, which may increase the risk of aspiration. We tested the effect of human saliva on the consistency of newly developed α-amylase-resistant (AR) products in comparison with standard ST.

METHODS

Materials: AR products: Nutis® Thickened Water (ARW), Fortimel® Fruit supplement (ARF), artificial tap water (10°DH) thickened with Nutis® Powder (ARP). Control: artificial tap water (10°DH) thickened with standard ST. 100g water was thickened to custard consistency with ARP or ST. Custard consistency was defined as being 1200 – 1400 mPa.s measured at 50 s⁻¹ and at 20°C.

Saliva: Human saliva was collected from several persons on several days. Small batches of saliva having a similar activity (217 U/ml) were stored at -20°C. Amylase activity was determined using the α-amylase Assay Procedure (Ceralpha method, ICC Standard No. 303) using HR Reagent (Megazyme R-AMHR4).

In vitro study: 10 minutes after preparation of the thickened drinks, 1 ml of saliva was added. After 10 minutes and 50 minutes the amount of decantable thin liquid formed was measured by weight. The change in consistency was determined by measuring the uniaxial compression force with a Stable Micro Systems TA-XT2i Texture Analyser.

In vivo study: About 32 healthy subjects participated in these double-blind cross-over studies. Each subject performed four tests (2 products and 2 mixing times) on the first day. The same set in different order was tested the next day. The tests were offered in two different orders concerning time and product type. In each test, the subject took one spoon of 10g product (AR or ST). Persons were instructed to move the tongue approximately 1 rotation per second. After 10 and 20 seconds the bolus was spat out into a coded cup containing 1 ml 0.2N HCl and mixed to stop α-amylase activity. Closed cups were stored at -20°C.

Viscosity measurements on thawed samples were performed in a rotational rheometer using Couette-DIN geometry. The viscosity was obtained after 300 seconds. The relative viscosity was calculated as the percentage remaining viscosity compared to the viscosity at time zero.

RESULTS

In vitro study:
After addition of human saliva, the amount of decantable thin liquid formed for AR products was below 0.6g of the total amount (Figure 1).

For ST the amount of decantable thin fluid formed on top of the drink was 13 to 18g (P<0.01), which corresponds with 2 to 3 boluses. After addition of human saliva, the value for the maximum compression force for AR products was relatively unaffected or even showed an increase (Figure 2). The values were significantly different for water thickened with ST (P<0.05). For ST the force decreased with almost 10% after 10 minutes and with more than 20% after 50 minutes, showing a decrease in consistency. This result is in good agreement with the formation of thin liquid with ST.

Figure 2. Changes in compression force after exposure of ARF, ARW and water thickened with ARP, and water thickened with ST to human saliva for 10, resp. 50 minutes compared to exposure to water. P<0.05.

In vivo study:
After treatment in the mouth, the relative viscosity of water thickened with ST was 20% after 10 sec and 7% after 20sec. The values were significantly higher for AR products (P<0.0001). After 10 sec relative viscosity was 77% for ARW and 61% for ARF and water thickened with ARP, and after 20 sec the relative viscosity was 60% for ARW and 45% for ARF and water thickened with ARP. The relative viscosity for AR products after 20 sec remained significantly higher compared to that of water thickened with ST at 10 sec. This shows that AR products retain their consistency considerably better than ST products once in contact with human saliva.

Figure 3. Relative viscosities (percentage of viscosity at 0 seconds) of water thickened with ARP, ARF, ARW, and water thickened with ST after manipulation in the mouth for 10 and 20 seconds. * P<0.0001.

CONCLUSION

Once in contact with human saliva, AR products retain their prescribed consistency significantly better than water thickened with ST. Therefore the use of amylase-resistant thickener combinations might support safer swallowing in patients with Dysphagia.

REFERENCES