

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

رَبِّ اشْرَحْ لِي صَدْرِي 0 وَيَسِّرْ لِي أَمْرِي 0
وَ اَخْلُ عُقْدَةً مِّنْ لِّسَانِي 0 يَفْقَهُوا قَوْلِي 0

اے میرے رب! میرا سینہ کھول دے اور میرے لیے میرا کام آسان کر دے اور
میری زبان کی گرہ کھول دے تاکہ لوگ میری بات سمجھ سکیں

رَبِّ زِدْنِي عِلْمًا

MY LORD! INCREASE ME IN KNOWLEDGE.

FST-311. L # 25: PROTEINS & FUNCTIONAL PROPERTIES (FP)

- **FUNCTIONAL PROPERTIES**
- **RATIONALE**
- **ALTERATION OF FOOD PROTEINS TO DEVELOP FP**
- **IMPORTANT FUNCTIONAL PROPERTIES**
- **WATER BINDING / HOLDING ABILITY**

PROTEINS: FUNCTIONAL PROPERTIES

“THOSE **PHYSICAL** AND **CHEMICAL** PROPERTIES OF PROTEINS THAT **INFLUENCE** THEIR **BEHAVIOR** IN **FOOD SYSTEMS** DURING **PREPARATION**, **PROCESSING**, **STORAGE** AND **CONSUMPTION**, AND CONTRIBUTE TO THE **QUALITY** AND **ORGANOLEPTIC** ATTRIBUTES OF FOOD SYSTEMS”.

- **MANY FOOD PRODUCTS OWE THEIR FUNCTION TO FOOD PROTEINS.**

<http://cdn.intechopen.com/pdfs-wm/15717.pdf>

RATIONALE: FUNCTIONAL PROPERTIES

- MANY FOOD PRODUCTS OWE THEIR FUNCTION TO FOOD PROTEINS
- IT IS IMPORTANT TO UNDERSTAND PROTEIN FUNCTIONALITY TO DEVELOP AND IMPROVE EXISTING PRODUCTS AND TO FIND NEW PROTEIN INGREDIENTS

<http://cdn.intechopen.com/pdfs-wm/15717.pdf>

ALTERATION OF FOOD PROTEINS

THE PROPERTIES OF FOOD PROTEINS ARE ALTERED BY

- ENVIRONMENTAL CONDITIONS
- PROCESSING TREATMENTS
- INTERACTIONS WITH OTHER INGREDIENTS

Processing Methods

HEATING
FREEZING
DRYING
SHEARING OR MIXING
PRESSURE

Protein Structure

AMINO ACID COMPOSITION
AMINO ACID SEQUENCE
REGULAR FOLDING OF PROTEIN
CONFORMATION
SUBUNIT COMPOSITION
MOLECULAR MASS

Environmental Conditions

pH
IONIC STRUCTURE
TYPE OF SALTS
MOISTURE CONTENT
OXIDATION-REDUCTION
POTENTIAL

Physicochemical Properties

SURFACE CHARGE
HYDROPHOBICITY
THERMAL STABILITY
FLEXIBILITY
ASSOCIATION / DISSOCIATION
BEHAVIOR

Functional Properties

IMPORTANT FUNCTIONAL PROPERTIES

FUNCTIONAL PROPERTY	FOOD SYSTEM
WATER HOLDING ABILITY	MUSCLE FOODS, CHEESE, YOGURT
SOLUBILITY	BEVERAGES, PROTEIN CONCENTRATES / ISOLATES
GELATION	MUSCLE FOODS, EGGS, YOGURT, GELATIN, BAKED GOODS
EMULSIFICATION	SALAD DRESSING, MAYONNAISE, ICE CREAM,
FOAMING	WHIPPED TOPPINGS, ANGEL CAKE

FP; WATER HOLDING ABILITY..

Factors Influencing Water Binding Capacity

Protein Type

- more **hydrophobic** = less water uptake / binding
- more **hydrophilic** = more water uptake / binding

Protein Concentration

- more **concentrated** = more water uptake

Protein Denaturation (Influence of temperature)

- if a protein forms a **gel** on heating (which denatures the proteins) then it would get more water binding
- water would be physically **trapped** in the gel matrix

FP: WATER HOLDING ABILITY

Water Binding

- The ability of foods to **take** up and /or **hold** water is of paramount importance to the **Food Industry**
- More **H₂O** > Higher product **Yield** > Higher **Financial Benefit**
- Product quality may also be **Better**, more **Juiciness**

WATER HOLDING ABILITY- FACTORS AFFECTING

1. Thermal Denaturation

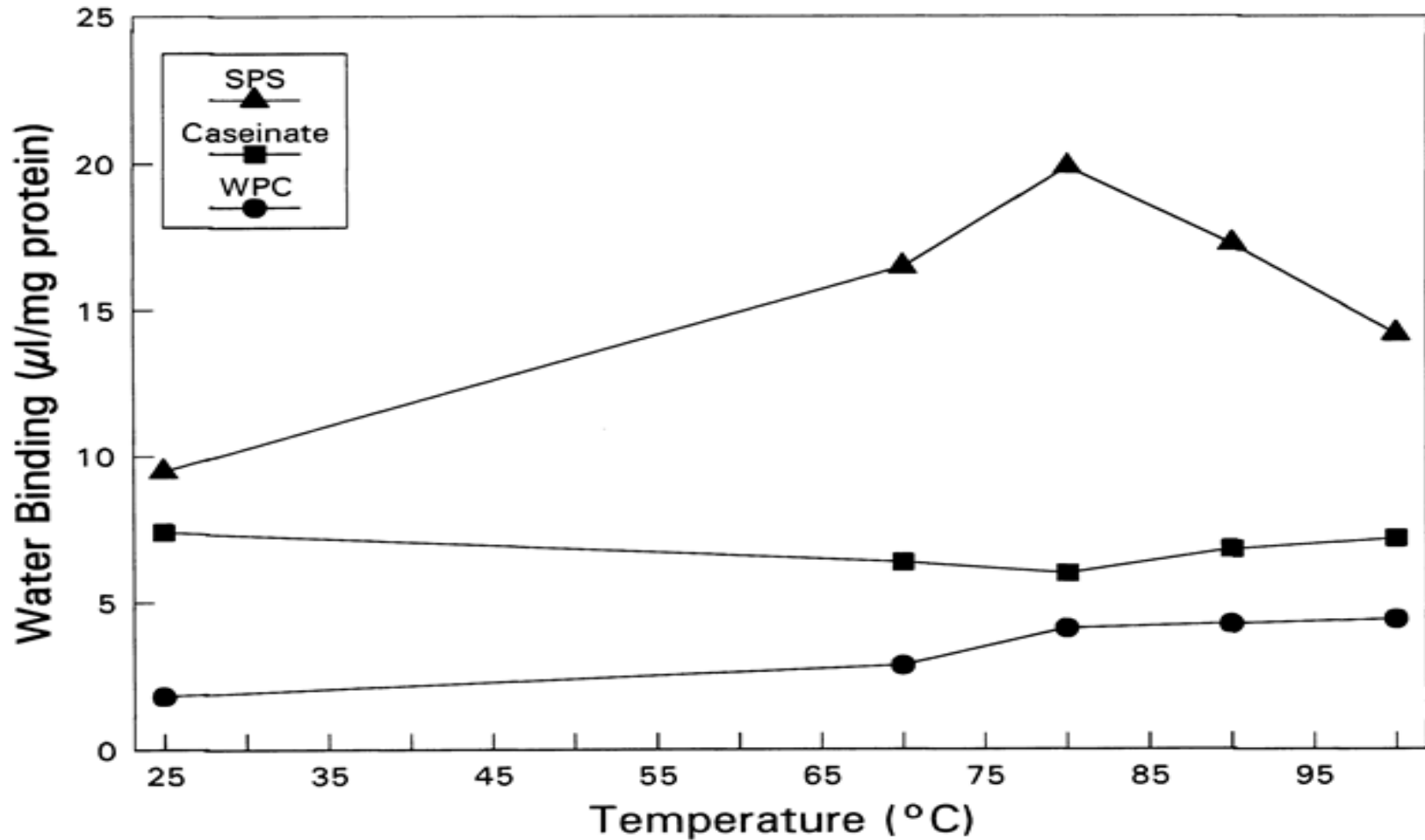
SPS: Soy protein isolate → forms Gel on Heating

Caseinate: Milk proteins (casein) → does Not Gel on Heating

WPC: Whey protein concentrate → forms Gel on Heating

WATER HOLDING ABILITY- FACTORS AFFECTING

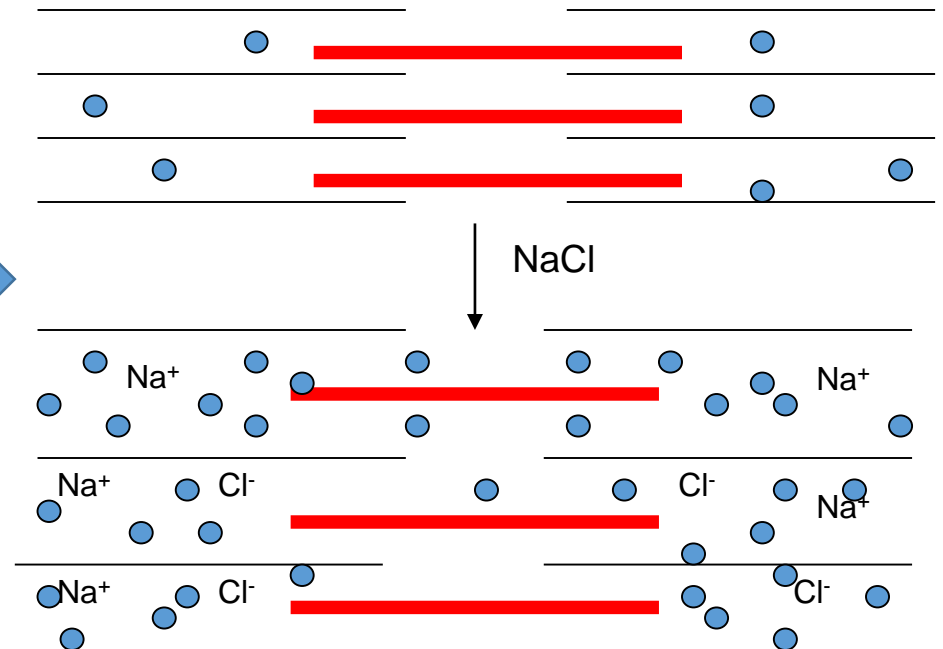
1. Thermal Denaturation



WATER HOLDING ABILITY- FACTORS AFFECTING

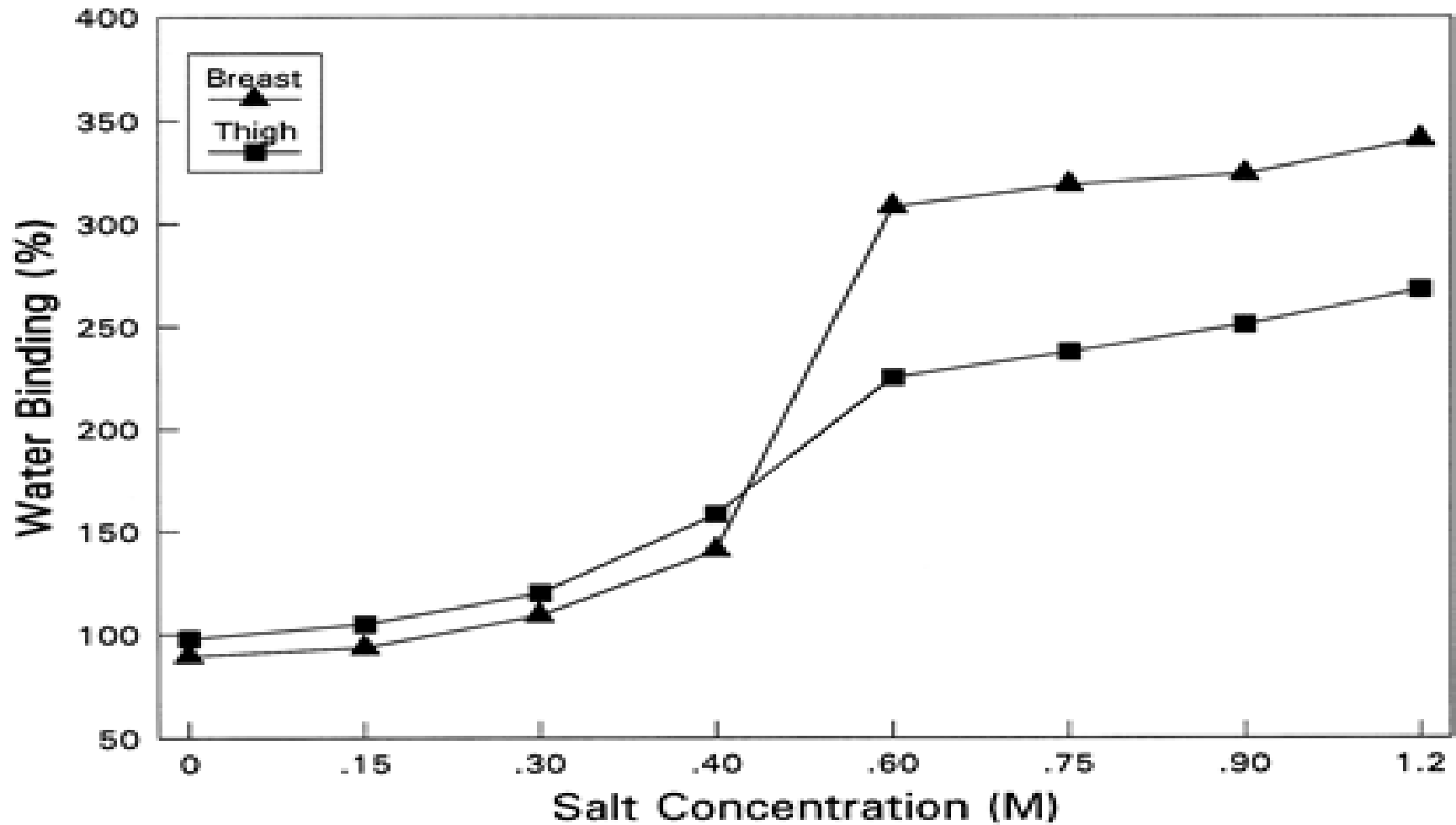
2. Salt Concentration

- Highly protein dependent / muscle proteins



WATER HOLDING ABILITY- FACTORS AFFECTING

2. Salt Concentration

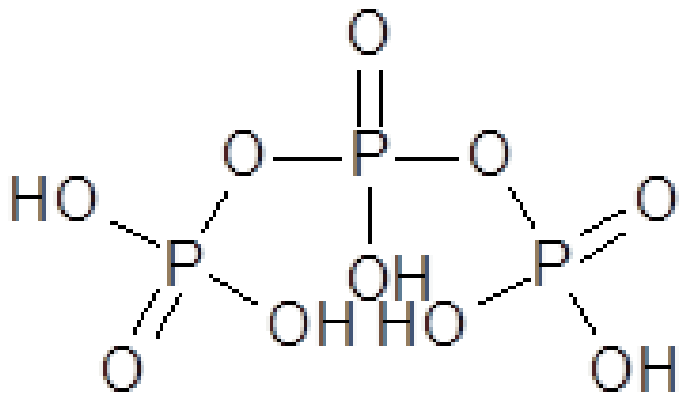


WATER HOLDING ABILITY- FACTORS AFFECTING

2. Salt Concentration

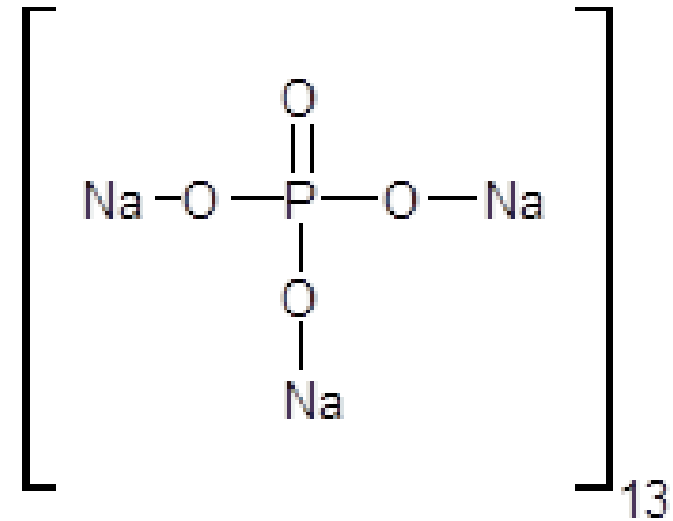
- **Phosphate** salts (in combination with **NaCl**) are frequently used in **Food Processing** to make food **Proteins** Bind and Hold more **Water**

Na Tripolyphosphate



Na Salt

Na Hexametaphosphate



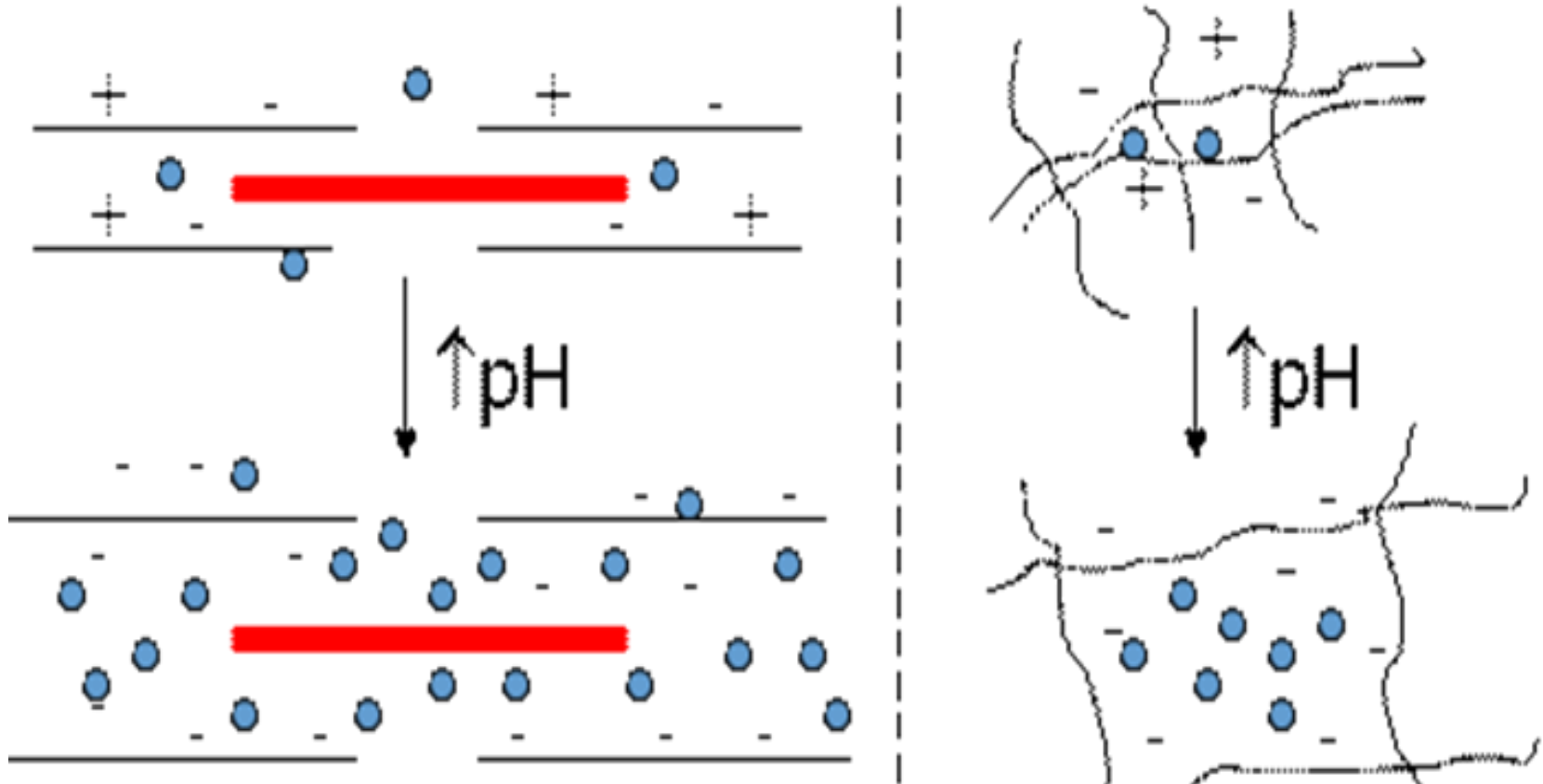
WATER HOLDING ABILITY- FACTORS AFFECTING

3. pH

- Great influence on the **Water Uptake** and **Water Binding Capacity** of proteins
- Water binding is **lowest** at **pI** since there is **no** effective **charge** and proteins typically **aggregate**
- Water binding **increases** greatly away from **pI**
- **Muscle** proteins and protein **gels** are a good example

WATER HOLDING ABILITY- FACTORS AFFECTING

3. pH



More repulsion and more water uptake/binding

WATER HOLDING ABILITY- FACTORS AFFECTING

3. pH

