

### Thyroid Gland Facts

- Thyroid cells are the only cells in the body which can absorb iodine from your food.
- Thyroid cells combine iodine and tyrosine (an amino acid) to make thyroid hormones.
- T3 and T4 hormones are carried by the blood throughout the entire body
- Every cell in the body depends upon thyroid hormones for regulation of their metabolism (conversion of oxygen and calories to energy)

### Thyroid Gland Facts

- 2 billion people globally don't get enough iodine (de Benoist et al., 2007)
- An underperforming thyroid gland can lead to heart disease, diabetes, cognitive decline and a variety of cancers
- Also linked to hormonal disruption in fertility and pregnancy
- Poor cognitive development and growth in children

## METABOLIC RATE

### What is Your Metabolic Rate?

T3 and T4 increase your basal metabolic rate. All body cells then work harder and therefore need more energy.

- Body temperature rises
- Heart beat becomes stronger; pulse is faster
- Food is used up more quickly (energy stored in liver and muscles is broken down)
- Brain develops (in children)
- Growth takes place (in children)
- Activation of the nervous system (higher attention levels and speed of reflexes)



### A Low Metabolic Rate & Hypothyroidism

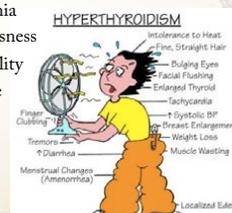
Thyroid produces too little T3/T4 hormone so the body runs too slowly. This can result in all or some of the following:

- General loss of energy/power
- Slowed metabolism
- Being overweight
- Tiredness & fatigue
- Difficulty concentrating
- Mental slowness
- Constipation
- Sensitivity to cold
- Slow pulse
- Waxy skin thickening and swelling (myxedema)
- Dry skin, brittle hair
- Deep, hoarse voice
- Loss of sexual desire or potency problems
- Fertility problems
- Sometimes depression
- Often mistaken for 'ageing'

### A High Metabolic Rate & Hyperthyroidism

Thyroid produces too many T3/T4 hormones so the body uses energy too quickly. This can result in all or some of:

- Hot flashes, sweating
- Trembling
- Racing heart
- Weight loss
- Diarrhoea
- Hair loss
- Potency problems
- Fertility problems
- Nervousness, hyperactivity
- Emotional instability
- Insomnia
- Restlessness
- Irritability
- Fatigue



### Hypo-Low v Hyper-High

**HYPOTHYROIDISM**

- Intolerance to Cold
- Receding Hairline
- Facial & Eyelid Edema
- Dull-Blank Expression
- Extreme Fatigue
- Thick Tongue
- Slow Speech
- Hair Loss
- Apathy
- Lethargy
- Dry Skin (Chairs & Sore)
- Muscle Aches & Weakness
- Constipation
- Anorexia
- Brittle Nails & Hair
- Menstrual Disturbances
- Late Clinical Manifestations: Subnormal Temp, Bradycardia, Weight Gain, ↑ LDL, Thickened Skin, Carpal Complications

**HYPERTHYROIDISM**

- Intolerance to Heat
- Fine, Straight Hair
- Bulging Eyes
- Facial Flushing
- Enlarged Thyroid
- Tachycardia
- ↑ Systolic BP
- Breast Enlargement
- Weight Loss
- Muscle Wasting
- Localized Edema
- Finger Clubbing
- Tremors
- ↑ Diarrhea
- Menstrual Changes (Amenorrhoea)

**HOW DO YOU KNOW?**

ORIGINAL FORMULA

### Blood Tests for TSH and T Hormones

Blood tests for TSH are an early indicator of thyroid function

TSH	FREE T4 (FT4)	FREE T3 (FT3)	USUAL DIAGNOSIS
0.4 to 4.5	10 to 24	2.3 to 4.2	Normal thyroid function
High	Normal	Normal	Mild hypothyroidism (underactive)
High	Low	Low/Normal	Hypothyroidism (underactive)
Low	Normal	Normal	Mild hyperthyroidism (overactive)
Low	High/Normal	High/Normal	Hyperthyroidism (overactive)
Low	Low/Normal	Low/Normal	Secondary hypothyroidism (rare pituitary illness)
Normal	High	High	Thyroid hormone resistance syndrome



### Urinary Iodine Concentration UIC

The standard urine test for iodine sufficiency

Median UIC (µg/L)	Iodine intake	Iodine status
<20	Insufficient	Severe iodine deficiency
20-49	Insufficient	Moderate iodine deficiency
50-99	Insufficient	Mild iodine deficiency
100-199	Adequate	Optimal
200-299	More than adequate	Risk of iodine-induced hyperthyroidism in susceptible groups
≥300	Excessive	Risk of adverse health consequences (iodine-induced hyperthyroidism, autoimmune thyroid disease)

### Sources of Iodine

How to assess iodine nutrition based on your daily diet. Each portion will provide enough iodine if taken daily.

- FISH**: 1 1/2 whole mackerel a day
- EGGS**: 2 eggs per day
- MILK**: 3 large glasses a day
- FORTIFIED FOODS**
- SEAWEED**: 1 heaped teaspoon every 3 days
- NAPIERS SEAGREENS**: 1 capsule per day

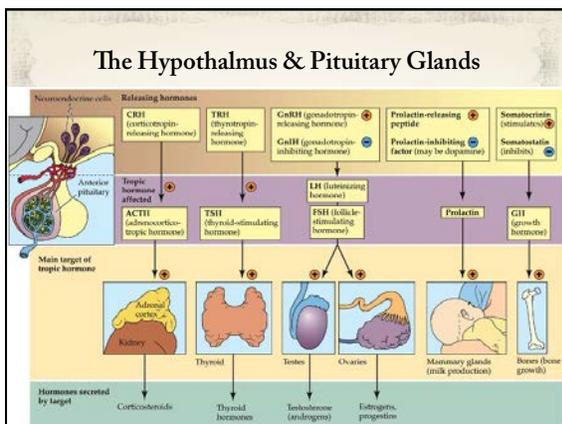
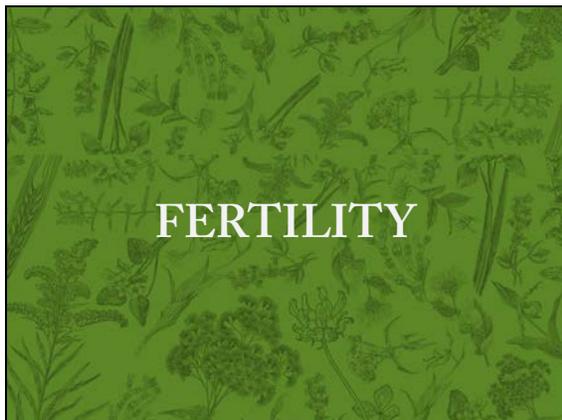
### Sources of Tyrosine

Thyroid cells combine iodine and tyrosine to make T hormones

- 2050mg Seaweed, raw
- 1782mg Seaweed, dried
- 1620mg Shellfish
- 1500mg Chicken (up to)
- 1500mg Pork (up to)
- 1484mg Tuna
- 1483mg Spinach (up to)
- 1263mg Watercress, raw
- 1261mg Sesame seeds
- 1195mg Beef (up to)
- 1006mg Beans
- 52mg Oranges
- 4 mg Apples



\*in a 200 calorie serving



### Thyroid > Hypothalamus > Pituitary > Thyroid

The hypothalamus in the brain releases hormones to drive the pituitary gland to secrete at least six different 'action' (tropic) hormones. Including:

- LH/FSH > Testosterone (affects male fertility)
- LH/FSH > Estrogens (affects female fertility)
- Prolactin (controls breast milk production)
- GH (growth hormone)

TSH > Thyroid hormones T3 and T4

**IN TURN:**  
Thyroid hormones return to the hypothalamus, the pituitary gland and controls the speed of their metabolism.

### Thyroid and Fertility Studies

In hyperthyroidism, problems conceiving are usually due to light/infrequent periods. In hypothyroidism, it is long/heavy periods or light/infrequent periods, miscarriage or infertility.

- High serum TSH levels are a significant predictor of IVF failure. TSH levels are significantly higher among women who produce eggs that failed to be fertilized (Camer et al)
- 1991: 20% of infertility patients were found to have thyroid problems (Gehard et al)
- 1999: 2.3% of infertility patients had elevated TSH levels but no symptoms of hypothyroidism. 69% had ovulatory dysfunction. After treatment with levothyroxine 64% later became pregnant (Lincoln et al)

### Fertility: Seaweed, Iodine & Your Thyroid

- 2012: 24% of infertility patients were found to be hypothyroid. After treatment with levothyroxine 77% conceived in under 1 year (Verma et al)
- 2015: 54% of infertility patients were found to be hypothyroid. After treatment with levothyroxine 33% conceived in under 2 years (Papa et al)

The evidence is overwhelming that poor thyroid function is critically linked to fertility problems especially ovulatory problems and poor IVF/ART results

### Fertility: Seaweed, Iodine & Your Thyroid

There is a concern that iodine deficiency is reappearing in developed countries (despite salt iodization in many) because diet-conscious young women may avoid salt, dairy and bread (Rose et al., 2006)

- A healthy thyroid gland is critical to hormone production and to fertility and successful pregnancies.
- If concerned, get TSH tests before trying to conceive
- Maintain sufficient dietary iodine intake *before* it becomes a problem and affects your thyroid
- Encourage young women, *from their teens*, to add seaweed to their diet

## PREGNANCY

### Baby: Seaweed, Iodine & Your Thyroid

For unborn babies, a lack of iodine in their mothers can lead to poor fetal development, poor future cognitive function and poor mental abilities.

- Autism in children is four times more likely if the mother has a weakened thyroid gland while pregnant (Ramin et al., 2013).
- Even mild iodine deficiency during pregnancy has an irreversible impact on children's educational outcomes in the first 9 years of life (Hynes et al., 2013)
- These are long-term negative impacts as a baby's cognitive development is not improved by iodine correction in childhood (Hynes et al., 2013).
- 49% of babies are mildly iodine insufficient (Stearns et al., 2005)

### Mothers: Seaweed, Iodine & Your Thyroid

Iodine requirements are increased more than 50% during pregnancy especially in the first 5 weeks (Zimmerman 2012)

- Iodine deficiency is a problem in the general, as well as the pregnant population, in 5 European countries - one of which is the UK (Lazarus, 2014)
- British researchers say that iodine deficiency in pregnant women should be treated as an important public health issue (Bath et al., 2013)
- Despite the fact that two thirds of the pregnant women in the UK are iodine deficient, the government has still not recommended iodine supplementation in pregnancy (Lazarus 2014)

### Mothers: Seaweed, Iodine & Your Thyroid

- There is a link between having thyroid antibodies and the risk of developing diabetes during pregnancy (Yang et al., 2015).
- High occurrence of antibodies are reported in women with recurrent miscarriages, varying from 19% to 36%, sub fertility and premature birth (Vaisenberg et al., 2015)
- Thyroid antibodies are also associated with postpartum thyroiditis (Vaisenberg et al., 2015)

... fatigue... exhaustion... depression...  
Baby blues or thyroid problems?



### No State Iodine Supplementation ~ Norway

61,904 pregnant women took part in a national survey

- Study found low use of iodine-containing supplements and low intake of milk/yogurt, seafood and eggs
- 67% relied on dairy products as their main source of iodine  
(Bjornseter et al., 2012)
- Only 31.6% took iodine-containing supplements

### Pregnant Women in Norway

Out of the 61,904 surveyed pregnant women:

- 16% had an iodine intake **below** 100  $\mu$ g/day
- 42% had an iodine intake **below** 150  $\mu$ g/day
- 22% reached the **recommended** 250  $\mu$ g/day

Basically only 1 in 5 women had enough iodine in their diet to safely sustain a healthy pregnancy

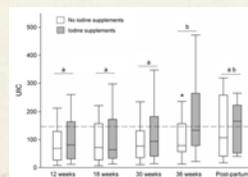
#### Study Conclusion:

Pregnant women are unlikely to reach recommended iodine levels without an iodine supplement



### State Supplementation ~ Australia

Iodine fortification program via bread since October 2009  
Yet... pregnant women still found to be iodine insufficient



The impact of iodine supplementation and bread fortification on urinary iodine concentrations in a mildly iodine deficient population of pregnant women in South Australia.  
(Clifton et al., 2013)

### Pregnant Women in Australia

#### Study Findings:

- Many women were deficient and eating fortified bread only increased urinary iodine from 68  $\mu$ g/L to 84  $\mu$ g/litre
- Women not taking supplements were iodine deficient and still under 90  $\mu$ g/L
- Only women taking iodine-containing multivitamins were within WHO recommendations (150–249  $\mu$ g/L)

#### Study Conclusion:

Pregnant women are unlikely to reach recommended iodine levels without an iodine supplement, despite mandatory iodine supplementation of bread since October 2009

## BREASTFEEDING

### Breastfeeding: Seaweed, Iodine & Your Thyroid

- Iodine is secreted into breast milk as the growing infant needs iodine for brain development and bone growth
- So the UIC of nursing mothers is expected to drop and be less than that of pregnant women
- In a Swiss study, mothers of 6 and 12-month-old infants were iodine deficient; their overall UIC was  $75 \mu\text{g/litre}$  - less than half of their UIC in pregnancy
- The months after the birth are one of the most common times for a woman to receive a hypothyroid diagnosis
- Unless you want to consume iodised salt or fortified foods, adding seaweed to your diet is essential while breastfeeding

## THE EARLY YEARS

### Iodine Deficiency in Babies

It is particularly important for children and babies to have enough thyroid hormones, because a lack of these hormones, at an early stage of life, can have severe effects on both physical and emotional development

- Mild iodine deficiency during pregnancy can trigger hypothyroid diagnosis in a new mum
- Iodine deficiency in mothers is the leading **preventable** cause of intellectual impairment in children (WHO, 2004)
- Serious impacts on future cognitive function.

## SWITZERLAND

National Supplementation Program

## SWITZERLAND

“The Swiss iodized salt program provides adequate iodine for school children and pregnant women, *but* weaning infants not receiving iodine-containing complementary foods are iodine deficient, as are their mothers” (Anderson et al, 2010).

**Study Conclusion:** National iodized salt programs do not adequately protect most new mums and their babies

## SWITZERLAND

Infants on infant formula had higher UICs than breastfed children from mothers not taking a supplement

Infants not receiving iodine-fortified formula milk during weaning were clearly deficient, with an UIC of  $74 \mu\text{g/litre}$

So a clear argument for adding iodine to infant formula?

*However...*

## WHAT'S IN THE TIN?

TABLE 1. Comparison of labeled and measured iodine concentrations in different brands of formula milk and infant cereals

Brand/product specification	Iodine concentration*			
	Labeled ( $\mu\text{g}/100 \text{ kcal}$ ) <sup>b</sup>	Labeled ( $\mu\text{g}/100 \text{ ml}$ )	Measured ( $\mu\text{g}/100 \text{ ml}$ ) <sup>c</sup>	Difference (%) <sup>d</sup>
<b>Infant formulae<sup>e</sup></b>				
Bimbosan <sup>f</sup>	7.1	4.8	4.6	-3.3
Bimbosan Bio <sup>g</sup>	7.7	5.2	4.5	-13.2
<b>Follow-up formulae<sup>h</sup></b>				
Adapta 2 <sup>i</sup>	14.5	10	9.1	-8.8
Coop Naturaplan Bio Galactina 2 <sup>j</sup>	14.7	10	12.6	26.5
HFF Fidgeisich 2 <sup>k</sup>	14.3	11	11.6	5.8
Holle Bio 2 <sup>l</sup>	9.3	7	9.4	34.3
Milupa Aptamil 2 <sup>m</sup>	17.6	12	13.2	10.0
Milupa Aptamil HA 2 <sup>n</sup>	19.1	13	11.1	-14.6
Milupa Mikumil 2 <sup>o</sup>	19.1	13	11.5	-11.5
Nestlé Beba 2 <sup>p</sup>	23.9	16	14.8	-7.6
Nestlé Beba HA 2 <sup>q</sup>	14.9	10	9.3	-6.9
<b>Soy-based formula</b>				
Bimbosan Bio soy <sup>r</sup>	9.8	6.5	7.8	19.5
<b>Brand/product specification</b>	<b>Labeled (<math>\mu\text{g}/100 \text{ kcal}</math>)<sup>b</sup></b>	<b>Labeled (<math>\mu\text{g}/\text{portion}</math>)<sup>b</sup></b>	<b>Measured (<math>\mu\text{g}/\text{portion}</math>)<sup>c</sup></b>	<b>Difference (%)<sup>d</sup></b>
<b>Instant milk cereals (to be prepared with water)</b>				
Milupa Mikavid plus <sup>s</sup>	19.1	36	33.5	-6.9
Nestlé Baby Cereals Vollkorn mit Fruchtster <sup>t</sup>	8.5	18	18.3	1.7
Nestlé Baby Menu Milchgiess <sup>u</sup>	21.4	45	46.2	2.7
<b>Instant cereals (to be prepared with milk and water)</b>				
Galactina Ceralino Milchzusatz Getreide und Ovomatine <sup>v</sup>	10.7	40 <sup>b</sup>	37.4 <sup>c</sup>	-6.5

## SWISS AVERAGES

The report also states

“The Swiss iodized salt program provides adequate iodine for school children” (Andersson et al, 2010)

916 children (6 - 13 years) **median** UIC was **120  $\mu\text{g}/\text{litre}$**   
*but...*

330 children (36%) had an UIC of **less than 100  $\mu\text{g}/\text{litre}$**

While *median* average is considered ‘sufficient’ statistically it is not acceptable that 360 children per thousand lack iodine!!

## GIRLS v BOYS

In the same Swiss study

The **median** UIC of the **girls** was **113g/litre**

The **median** UIC of the **boys** was **124g/litre**

Other studies also show that girls are more at risk than boys, and women are at more risk than men of developing hypothyroidism

Don't wait to supplement... by 14 years old, 76% of British teenage schoolgirls are iodine insufficient (Vanderpump et al., 2011)

## RECOMMENDATIONS

### Ensure Optimum Iodine Intake

Make sure that you eat the following daily!



#### SEAWEED

1 heaped teaspoon every 3 days



#### EGGS

2 eggs per day



#### MILK

3 large glasses a day



#### FISH

1 1/2 whole mackerel a day



#### FORTIFIED FOODS



#### NAPIERS SEAGREENS

1 capsule per day

### But I have a good diet...

- Even if you have a good diet, unless you eat a lot of sea fish and seaweed, you will probably be mildly iodine deficient
- A Danish study found that women taking just iodised salt were not protected as well as those who took an iodine supplement (Andersen et al., 2013)
- Nor were they protected if they took a multivitamin with only 150mcg iodine in it ~ the current British recommended daily allowance (RDA) (Vanderpump et al., 2013)
- Also other chemicals near iodine in the periodic table, such as chlorine and fluorine, displace iodine
- Fluoride toothpaste and oral care products, and chlorinated water may interfere with iodine uptake

### How Much Iodine in Pregnancy

WHO and UNICEF both recommend that pregnant women take a **minimum of 250 mcg** of iodine a day (Aizizi & Smyth, 2009)

An increase up from the minimum UK RDA of 150 mcg

However, women taking a multivitamin with only 150 mcg iodine in, can still be insufficient (Vandevijvere et al., 2013)

One teaspoonful (approx 1 gram) of powdered seaweed supplies around 750 mcg of iodine.

One 500mg Napiers Seagreens capsule supplies 350 mcg

### The Periodic Table of Elements

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Uuq	115 Uup	116 Uuq	117 Uuq	118 Uuo
Lanthanides			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
Actinides			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

**F = Fluorine**  
**Cl = Chlorine**  
**Br = Bromine**  
**I = Iodine**

**ISN'T TOO  
MUCH SEAWEED  
DANGEROUS?**

### Iodine Has A Bad Press Reputation

- The British daily allowance (RDA) 140  $\mu$ g/day
- British RDA for pregnant women 250  $\mu$ g/day

*but...*

- Japanese iodine intake – largely from seaweeds – averages 1,000-3,000  $\mu$ g/day (Zava & Zava, 2011)

### What is the recommended dose?

WHO and UNICEF both recommend that pregnant women take a minimum of **250 mcg** of iodine a day (Aizizi & Smyth, 2009)

Recommended safe upper limits per day

- UK Dept of Health (RDI) **1000 mcg**
- US Dept of Medicine **1100 mcg**
- World Health Organisation **1100 mcg**
- Japan Ministry of Health **3000 mcg**

### Japanese Health Statistics

Due to high seaweed consumption iodine intake (Zava & Zava, 2011)

- Average life expectancy: Japan 83 years v US 78 years
- Breast cancer mortality rate: Japan 3 times lower than US (1999)
- Breast cancer mortality rate: 50% increase for Japanese immigrants after 10 years in the USA (1999)
- Prostate cancer: Japan 10 times lower than US (2002)
- Heart related deaths: Japan 897 per 100k v US 1,415 per 100k
- Infant deaths: Japan 2.8 per 1,000 v US 6.8 per 1,000 (2004)



## Our research with the University of Glasgow and the Seaweed Health Foundation

At the beginning of the study we had (Combet et al., 2014)

- 50 healthy volunteers, average age 25
- 52% found to be iodine insufficient with corresponding high levels of TSH (*Thyroid Stimulating Hormone*)

Although they seemed healthy, their thyroids were malnourished and being deprived of iodine

## Our Research (Combet et al., 2014)

We wanted to test how seaweed and its iodine was absorbed by the body.

- We tested volunteers UIC after 350mcg potassium iodide
- We tested their UIC again after taking one Napiers Seagreens Organic Hebridean Kelp Capsule (One 500 mg capsule contains 350 mcg of chelated iodine)
- We measured their urine, blood and iodine levels at intervals
- Our volunteers then took one capsule of Napiers Kelp every day for a month

## What We Found Out

By the end of the study period:

- the chelated iodine (in the seaweed) increased their urinary iodine at **safe** levels
- it also **corrected** thyroid stimulating hormone (TSH) production back to **normal levels**
- the matrix structure of seaweed delays iodine absorption avoiding sharp peaks
- this matrix enables a sustained release of iodine over a 3 day period

They were now no longer malnourished!

## We also learned that Not All Iodine is Equal

Too much iodine can over stimulate the thyroid leading to an overactive thyroid.

**However, different types of iodine behave differently in the body.**

It is important to choose the right type of iodine and take the right amount.

- Potassium iodide – iodised salt and supplements like Iodoral
- Chelated (natural) iodine - seaweeds

## Potassium Iodide

- Potassium iodide is absorbed by the body very quickly
- It is excreted again within three hours
- This can cause short, sharp iodine spikes in the body
- Potassium iodide in salt is not good as too much salt in your diet can lead to high blood pressure
- There are some concerns in countries with iodized salt programs that people in these areas are ending up with overactive thyroid or autoimmune disease (Teng et al., 2011).

### Chelated iodine

- Chelated (natural) iodine is absorbed by the body slowly
- This does not create a spike
- It is excreted over a three day period.
- This creates a much more stable, steady supply of iodine for the thyroid (Combet, 2014)

### Eat Seaweed!

Our nation has a mineral deficiency affecting over half the population  
Young women planning families, pregnant women, new mums and young children are especially at risk  
Try some seaweed today and make it central to your daily diet.

The End

Thank You for Listening  
Any Questions?

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