

Development of taste and food preferences in children.

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Developmental agenda for feeding

In utero

Some weak preferences learned for strong flavours.

Birth

Innate preference for a sweet taste

Preference for few tastes, learned from milk diet

4-6 months

Window of acceptance for new tastes (solids)

Preference a function of exposure

Preference based on taste and smell

6-12 months

Sensitive period for the introduction of solid textures.

1- 2 years

Preference for food as a 'gestalt'

Food recognised by appearance.

Beginning of rejection of new foods, and some previously accepted foods



ready acceptance



onset of neophobia

disgust and contamination fears start

Taste programming in utero.

Some flavours of food eaten by the mother are transmitted to amniotic fluid and swallowed by the foetus.

Such flavours –such as garlic and aniseed – are recognised by the newborn infant.

New born infants will turn towards the smell of aniseed if their mothers have eaten it during pregnancy.

Menella et al (1995), Schaal et al (2000).

Infants of mothers who drank carrot juice during pregnancy were less likely to make negative faces when fed carrot flavoured cereal – compared with infants whose mothers had just had water.

However there was no difference in intake of the cereal between the two groups.

Menella et al (2001)

This effect is a very weak one. Tastes experienced in utero are not yet shown to be good predictors of food preference and intake in humans.

However, one study in rats, seems to show that rat pups whose mothers were fed high fat, sugar and salt diets in pregnancy, showed preferences for these foods at weaning, and increased body weight.

Bayol et al (2007)

At **birth** there is also-

- A preference for **sweet tastes**,
(all other tastes are neutral or aversive.)
- But, even bitter tastes can be accepted if the taste is linked with positive nutritional consequences, (e.g. a protein hydrolysate formula) and exposure is frequent.

Birth to 5 months -

There is some evidence that the flavour of infant formula milk fed to the infant affects later acceptance of drinks - but not foods – with that flavour (eg. soya formula, Nutramigen).

And evidence that a breast feeding mother's ingestion of certain foods affects her infant's preference for that food taste (eg. carrot), but not intake of the food.

Menella, Kennedy & Beauchamp, (2006), Menella, Jagnow & Beauchamp,(2005)

4 to 6 months -

the window of opportunity for the introduction of solids.

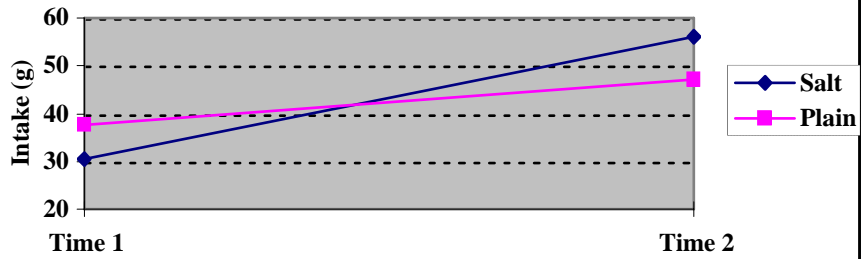
- **Infants readily accept new foods offered to them.**
- **There is no preference for 'bland' foods.**
- **Preference is a function of exposure.**
- **Fewer exposures are necessary at this age, than at later ages.**

Exposure at this time has a far stronger effect on intake.

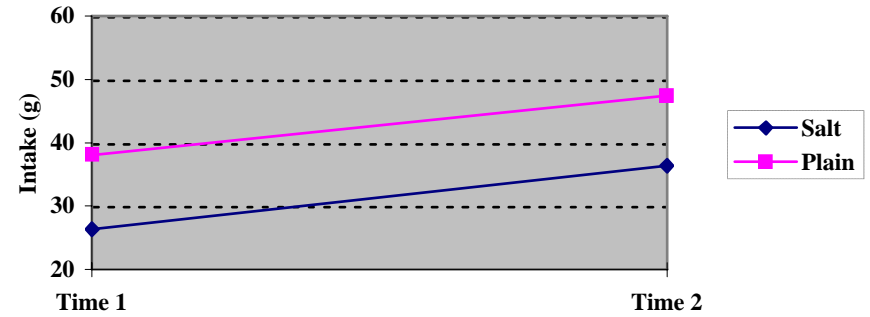
Johnson, 1999, gave infants a teaspoonful of a different tastant for 14 days, in the first food fed to them (mean age 14 weeks).

There is a clear exposure effect for sour and salted rice.

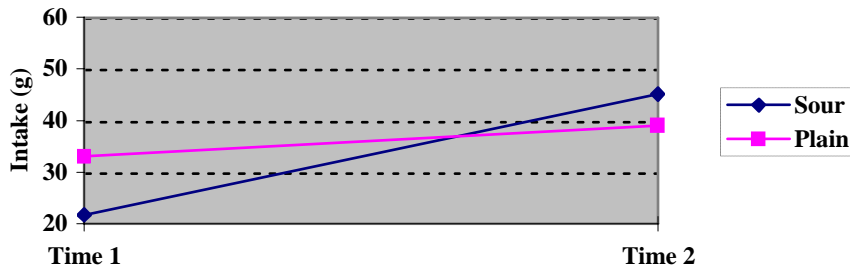
Consumption of Salt Rice (Exposure)



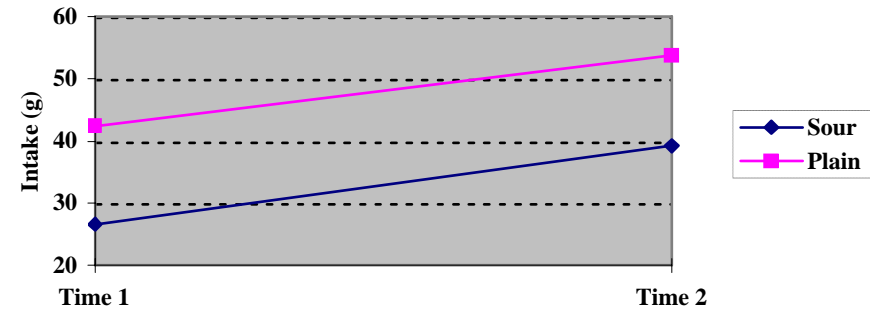
Consumption of Salt Rice (No Exposure)



Consumption of Sour Rice (Exposure)



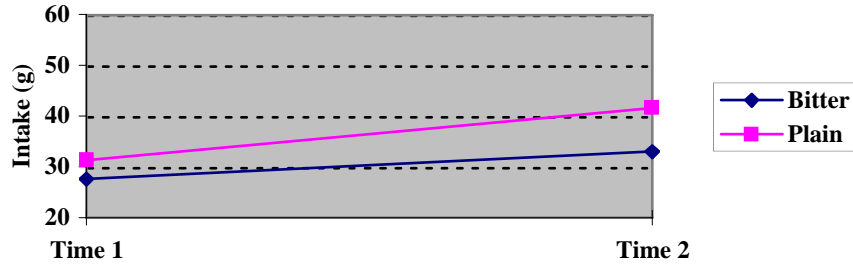
Consumption of Sour Rice (No Exposure)



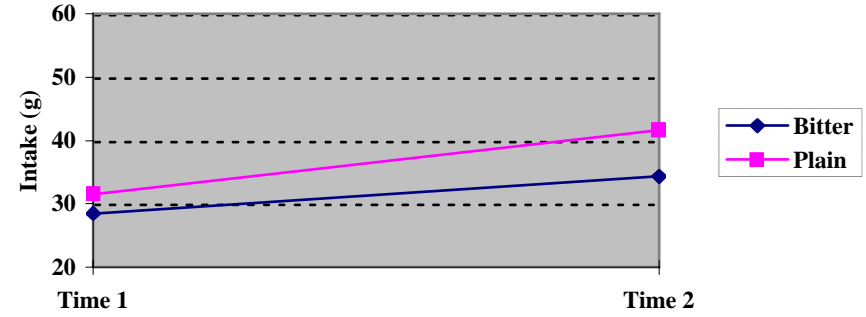
The infants given the bitter cereal were, however, slightly older than the other infants (mean age **17 weeks**).

For them, there was no exposure effect.

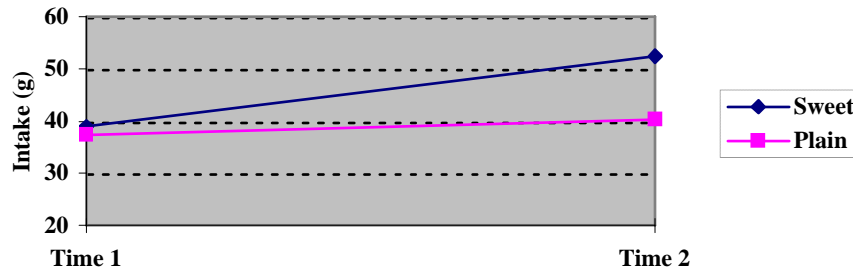
Consumption of Bitter Rice (Exposure)



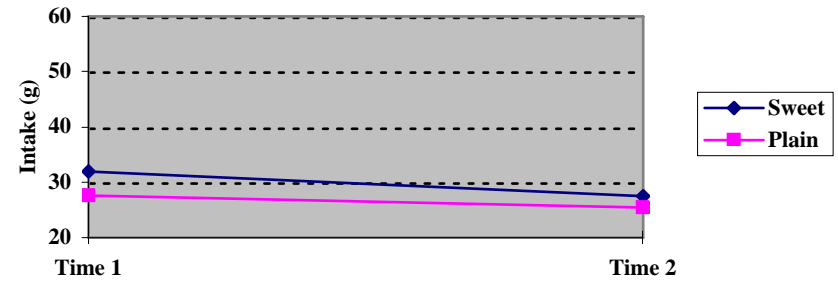
Consumption of Bitter Rice (No Exposure)



Consumption of Sweet Rice (Exposure)



Consumption of Sweet Rice (No Exposure)



Sullivan & Birch (1994) looked at repeated exposure to vegetables, in infants of 4 to 6 months.

All infants increased their intake after repeated exposure.

Exposure in the 4-6 month period can give quite taste specific preferences.

Peter is 5 months old he was introduced to solid foods at 4 months old.

He accepts a mixture of fruit that he is used to having, but shows a disgust response to a new food – broccoli - which has a bitter taste.

At this early stage, preferences for food tastes are learned through exposure.

Few exposures are needed at this age to gain a preference.

Exposure to food is generalised.

If many different tastes are given at this age then the infant is more likely to try a new food.

New foods do not have to be given one by one, a generalised effect is found if many foods are introduced.

Schaal, (2007)

This generalised effect is long term.

6 to 12 months-

sensitive period for the introduction of solid textures

- The tongue learns to move solid food around mouth in preparation for swallow.
- Infant learns to recognise food by sight.

Lack of experience at this stage may lead to poor acceptance of different textures

Northstone et al (2001) looked at the effect of the timing of the introduction of lumpy solid foods on subsequent feeding difficulties.

**Feeding difficulties
at 15 months.**

Age of intro.

<6mths	29.1%
6-9mths	38.6%
>10mths.	52.3%

We have looked to see whether this effect is still present in children of 7 years of age – using the ALSPAC data- base.

Children introduced to lumpy solids after the age of 9 months were reported as having more feeding problems at 7 years (food refusal and food ‘fussiness’).

(Coulthard, Harris, Emmett & Northstone.In press.)

But perhaps more interestingly we also found that there was a difference in the foods accepted by these children,

Children who were introduced to lumpy solids after 9 months of age ate fewer of all ten categories of fruit and vegetables than did children introduced to lumpy solids before this age.

Children introduced to lumpy solids before the age of six months ate more green vegetables, tomatoes and citrus fruits than did children introduced after 6 months.

Foods eaten by children at 7 years
according to age of introduction (%)

	<6mths N= 946	6-9mths 5457	>9mths 1418
Peas, broad beans	72.7	71.1	64.8
Sweet corn	70.2	68.4	61.7
Dark green veg.	78.2	73.9	70.1
Other green veg.	81.3	77.0	73.1
Carrots	91.9	90.8	88.5
Other root veg.	51.4	48.4	43.4
Tomatoes	60.7	55.1	49.7
Salad	68.5	65.9	61.4
Citrus fruits	82.3	79.0	74.8
Other fresh fruit	98.1	97.1	93.1

**Early exposure – before the age of 6 months
-predicts consumption of fruit and
vegetables at 7 years.**

**Weaning practices will therefore contribute
to later childhood diet – and possibly to
childhood obesity.**

12 to 18 months - the start of the neophobic response

- Preference for foods established- a combination of taste and texture.
- Foods identified by sight as 'known' or 'unknown' foods.
- Unknown foods are rejected on sight.

New foods, and some previously accepted foods will be rejected.

Toddlers become increasingly reluctant to try new foods during the second year of life – the neophobic stage.

They also stop eating foods that they use to eat.

Brown & Harris (2006)

During this process, infants become more aware of the ‘local’ details of food, and refuse to eat food that doesn’t look ‘right’.

They are also able to form quite sophisticated categories:-

- **of foods and non-foods**
- **of foods they like and foods they don't like.**
- **of things that are disgusting and things that are okay.**

Brown & Harris (2008)

Sometimes foods get moved between these categories.





Children move out of the neophobic stage because of :-

- **imitation** of other's behaviours.
- development of **food categories** and **and**
- **less emphasis on local features** of foods and objects.
- **exposure** to new foods.

Imitation does not occur in children who are on the autistic spectrum, neither is there a marked lessening of the attention to local detail and sensory sensitivity at this early age.

The neophobic response does not diminish.

Children imitate other adults – and their parents' eating behaviour, and will try new foods that they see their parents eat.

Harper & Sanders (1975)

Children of nursery school age will imitate the eating habits and food preferences of other children.

Birch (1979)

Children of 22 months can sort food and animals into separate groups.

Brown & Harris (2008)

The neophobic response is rejection of a food based on a perceptual mismatch.

Food is rejected on sight. Very small changes to a known food will result in rejection.

As children become able to form wider and more inclusive category sets so fewer foods are rejected.

In a study by Birch et al (1987)

**69% of 2 year olds refused a novel food
but only**

29% of 3 year olds

1% of 5 year olds

**So neophobia decreases with age,
but the number of exposures required to
induce a preference increases with age,
from one or two of certain tastes in the first
6 months, to 14 or so in later childhood.**

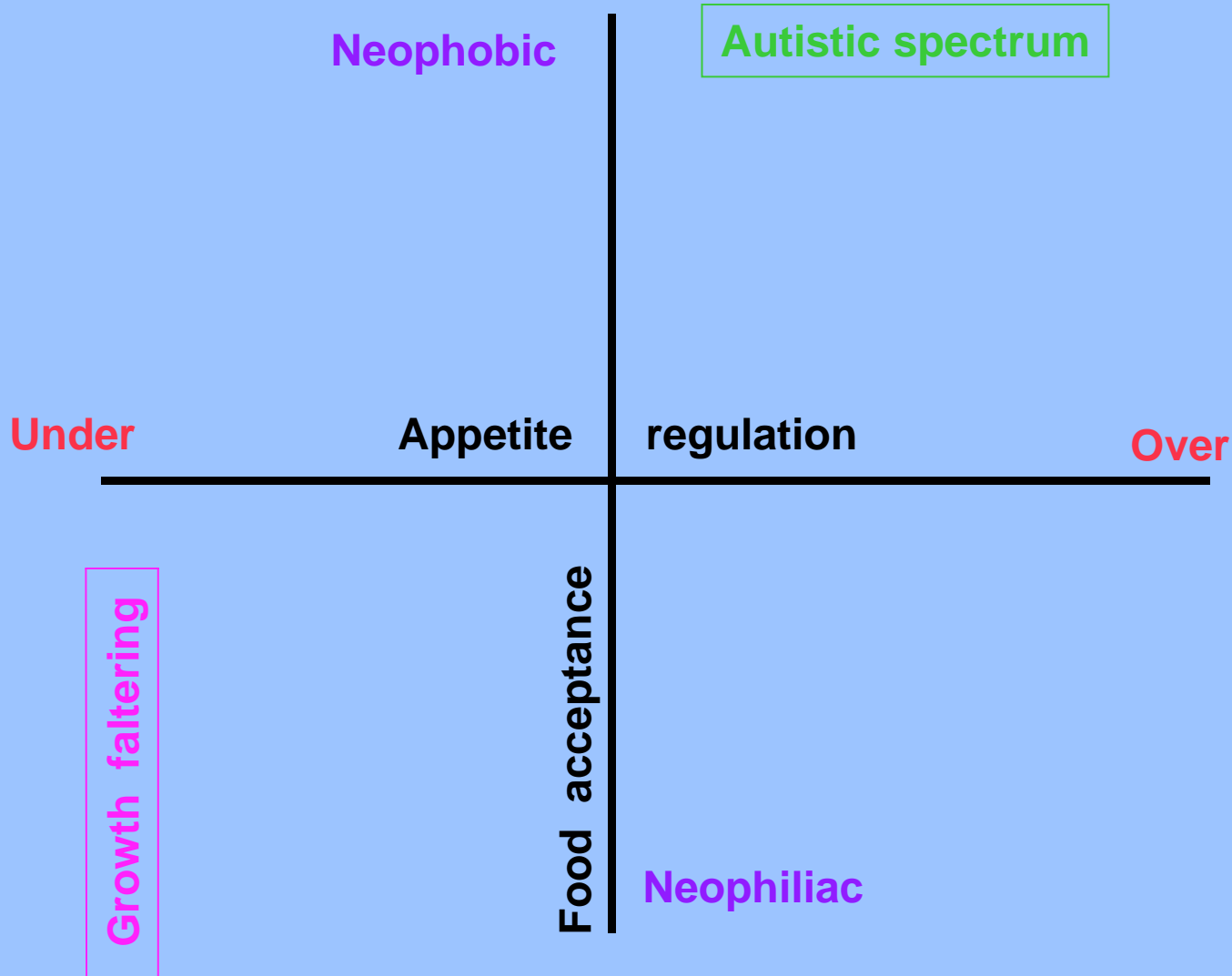
Are some children more difficult than others in accepting foods?

Children differ according to their **innate characteristics** and the the degree to which they are **sensory sensitive**. Both of these affect food acceptance.

Innate differences.

The extent to which children and adults are willing to accept a new food differs along a continuum - we are either **neophobic** or **neophilic**.

The dimensions of appetite regulation and food acceptance



Children who are 'fussy' eaters tend to score **high on emotionality** and **low on sociability** on measures of child temperament.

Some children find it difficult to accept foods if they differ ***from the known prototype***. These children tend to be.....

Sensory sensitive.

Children with these problems can show food refusal from :-

- the introduction of purees,**
- the introduction of lumpy textures,**
- 18 months.**

These children can dislike touch, sound, taste and smell. Visually they are hyper-aware of changes - especially to food packaging.

Extreme food refusal.

Innate disposition: -

- child shows extreme **anxiety** if offered new foods, or foods that they don't like; show **brand loyalty** and eating specific to context.
- child may **gag or vomit** if offered disliked foods.
- usually **boys**.
- often associated with **ASD**

How might parents contribute to food refusal?

Some parents:-

- continue **milk feeds** for too long,
- worry about their child **choking** and delay lumpy foods,
- worry about **dietary balance**,
- **force feed**,

Most of these problems are caused by **parental anxiety** about health and growth.

Advice for parents

DO

- ✓ Introduce **home prepared** foods.
- ✓ Introduce foods you want your child to eat **as a toddler**.
- ✓ The infant might look as if they don't like the food to begin with, but **persevere** unless they are really distressed.
- ✓ It isn't necessary to start with **bland** foods.

! The **experience**, not the amount is important.

! Don't try **second stage commercial** baby food, if your child has problems with lumps.

✓ Move from mash to '**bite and dissolve**' foods as quickly as possible (from 7 mths).

✓ Encourage the child in '**messy play**'.

✓ Eat the foods you want your child to eat.

DON'T

- **Force** feed.
- Use food one food as a **reward** for eating another.
- Put **disliked** food on the plate next to liked food.
- Expect all children to eat **as 'well'** as one another.

Above all **Don't Panic** - fussy children do grow out of it - although not until late childhood.

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- child may **gag or vomit** if offered disliked foods.
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- **Energy intake** must be the first priority.
- Dietary balance must take second place.

DO

- ✓ Give only the foods that **they will eat**.
- ✓ Give **short**, but **frequent** eating opportunities.
- ✓ Encourage and promote **messy play**.
- ✓ Help the child to **generalise** their food choices.

Look for other problems that might be worrying the parent - this type of food refusal occurs more frequently in children who are on the **autistic spectrum**