

NUTRITION THROUGH THE LIFECYCLE

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NUTRITIONAL NEEDS FROM PRECONCEPTION TO END OF LIFE

Regarding: the changing need for nutrition throughout life.

All of us, at all ages require a diet that is sufficient in carbohydrate, protein and fats and abundant in vitamins and minerals. However, nutritional needs change over the various life stages and are further impacted by genetics, health, environmental and social statuses.

SACN and UK Department of Health set guidelines for macro nutrient intake and energy recommendations and micro nutrient guidelines (SACN 2019). The recommended values are formulated from average intakes for healthy individuals. The micronutrient guidelines are not intended to be target intake value, but as a value to aim to exceed through dietary intake daily.

The dilemma currently facing developed countries including Asia and south America is that of increasingly over fed yet undernourished populations (WHO 2019). Where over processed, high sugared, high fat foods are abundant and relatively cheap in comparison to that of fresh, nutrient rich produce, leading to over consumption (Kearney 2010).
See appendix 1 for energy requirements.

The human body from a young age is predisposed to sweet foods to utilise the energy density. This has been an evolutionary trait that has served the previous generations well (Boeing et al 2016), so much so, that the population is set to exceed 8.1bn by 2025. Furthermore, the growing population is ageing, and non-communicable disease is increasing at an ever-increasing rate. The need for industry to assist demographics with specific food sources and the need for new social-cultural habits and relationships with food are required to ensure lifelong health.

Over nutrition starts early, this has been the case with previous dietary advice during pregnancy to significantly increase food intake, with the 'eating for two' mentality. Whilst the need to ensure quality nutrition is essential to deliver essential amino acids, essential fatty acids, vitamins and minerals for the development of the foetus and maintenance of parental health, the actual energy demands only increase by 300kcal per day in the 3rd trimester (NHS 2019). For those already in an overfed state do not need to increase energy intake. Additionally, excessive weight gain increases a greater risk of complications to pregnancy, birth and lifelong health. However, the assurance of micro-nutrient sufficiency is essential for both mother and infant for short- and long-term health in all populations.

Overfed children are at increased risk of developing poor dietary habits and metabolic damage with lifelong consequences. Exceeding the energy intake from 4 months and beyond has shown to accelerate fat cell generation that cannot be reversed, predisposing the individual to be at an increased risk of obesity later in life and the associated health consequences (Wahlqvist 2015). Therefore, careful selection of foods that are health enhancing should be prioritised.

Adolescents are also presented with a similar outcome of over consumption of energy dense-low nutrient foods. Throughout teen age years the consumption of high fat, high sugar and high salt foods is more commonly seen. Here the good health enhancing habits formed as a young child can be lost due to influences from peers and advertising campaigns.

Fertility

The full understandings of nutrition's impact on fertility has only recently been subjected to extensive research. The main focus has been on the role of antioxidants and micronutrients and the effects of alcohol, prescribed and recreational drugs.

Nutritional status may affect fertility directly and they also may influence the risk of several diseases that may impair fertility including polycystic ovarian syndrome, endometriosis and uterine fibroids. Research indicates an integral role for vitamins C, iron and arginine indicating the prevalence of achieving pregnancy. Many diseases or allergies

such as gluten intolerance and coeliac disease can impair fertility within women as this can cause malnutrition and malabsorption of nutrients (Sozck 2011).

However, the biggest concern of infertility in women in the Western world is obesity. Similarly, obesity is the main cause of causing male infertility in the Western world. In males the need for sufficient antioxidants is required to support reproductive health and sperm production. Research into the supplementation of carnitine and acetyl carnitine has shown to increase sperm number and motility by increasing the energy supplied (Mayoclinic 2019). Alcohol consumption is associated with a decrease of sexual hormones in both males and females. In males, research has shown high alcohol consumption contributes to impotence and to a reduction of blood testosterone concentrations (Drink Aware 2019).

Pregnancy and lactation

During pregnancy especially in the later stages there is an increased need for protein, minerals, vitamins and essential fatty acids to maintain personal health and foetal development (Cetin 2016). SACN recommends that a pregnant female increases their calorie consumption by 300 kcal per day for the last trimester of pregnancy. The foetus is expected to gain the majority of its birth weight within the last eight weeks of pregnancy. The Centres of Disease Control and Prevention (CDC) estimates at week 27 the foetus should weigh approximately 2 pounds, by week 32 foetus should weigh 4 pounds and at full term the foetus can be expected to weigh between 6 1/2 and 8 1/2 pounds (CDC 2019). The increased calorie consumption should be carefully considered predominantly coming from an increase of 7 g extra protein per day during pregnancy and 11 g extra during lactation. Minerals and vitamin needs remain the same during pregnancy.

During lactation there is a significant increased need calcium, phosphorus, magnesium, zinc, copper and selenium. Vitamin intakes during pregnancy increase for thiamine, riboflavin, folate, vitamin C, vitamin A and vitamin D (SACN 2019). There is also an increased need for dietary fibre. This is due to increased susceptibility to constipation as the foetus will press against the digestive tract and colon and the increased water usage. There is an increased need to consume more water this is due to increased cell volume needing higher levels of extra-and intracellular fluid, higher blood volume, increased body temperature, increased kidney function and increased frequency of urination due to the foetus pressing against the bladder. Increasing daily water intake will also ease constipation.

Table 1: Mineral daily nutrient requirements during pregnancy and lactation (SACN 2019)

Age	Calcium	Phosphorus ¹	Magnesium	Sodium	Potassium	Chloride ⁴	Iron	Zinc	Copper	Selenium	Iodine
Pregnancy	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
	700	550	270	1600	3500	2500	14.8	7	1.2	60	140
Lactation:	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
0-4 months	1250	990	320	1600	3500	2500	14.8	13	1.5	75	140
4+ months	1250	990	320	1600	3500	2500	14.8	9.5	1.5	75	140

Table 2: Vitamins daily nutrient requirements during pregnancy and lactation (SACN 2019)

Age	Thiamine	Riboflavin	Niacin	Vitamin B6	Vitamin B12	Folate	Vitamin C	Vitamin A	Vitamin D
Pregnancy	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
	0.9	1.2	13	1.2	1.5	300	50	700	20
Lactation:	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
0-4 months	1	1.6	15	1.2	2	260	50	950	20
4+ months	1	1.6	15	1.2	2	260	90	950	20

The supplementation of folic acid has been widely used, especially in the first trimester of pregnancy. Folic acid has shown to reduce neural tube defects within the foetus at critical developmental stages (Peña-Rosas & Viteri 2009). It is also good idea to eat foods that are high in folates natural form such as green leafy vegetables, whole grains, nuts, peas citrus fruits and berries. Vitamin D helps the body absorb calcium from your diet it is important for the mother and baby's bone development. The majority of vitamin D is taken from sunlight, but sun exposure is not possible or there is the need to cover skin for religious or personal reasons it is recommended to regularly supplement vitamin D (Akhtar 2019). Low blood levels of vitamin D are quite common in UK women, especially in the winter and early spring. There are only a few dietary sources of vitamin D; these include oily fish, eggs and some found in fortified breakfast cereals, fortified milk's and fat spreads.

It is common for women develop iron deficiencies during pregnancy however iron intakes are not needed to be increased during pregnancy or throughout lactation, but the daily need should be met to ensure anaemia is prevented. Good sources of iron are found in red meat, poultry, fish, beans, green vegetables, nuts and whole grains.

Infancy

During infancy the body is subjected to rapid development and therefore the requirement for macronutrients and micronutrients, on a per kilogram basis are higher than at any other developmental stage throughout life. The needs are mainly influenced by rapid cell division occurring during growth which requires protein, energy and nutrients involved in DNA synthesis, metabolism of protein, energy and fat. Increased needs for these nutrients are reflected in the daily recommended intakes of nutrients and micronutrients for these age groups (SACN 2017).

Breast milk offers significant advantages over manufactured formula. Breastfeeding is associated with the reduced risk of obesity, allergies, high blood pressure and type I and two diabetes. Those who are fed via breastmilk improved cognitive development and a decreased incident of severity of infections (Agostoni 2019).

The requirement of essential fatty acids is essential to play key roles in the development of the central nervous system, cell integrity and neurological development.

Table 3: Mineral daily nutrient requirements during infancy (SACN 2019)

Age	Calcium	Phosphorus	Magnesium	Sodium	Potassium	Chloride	Iron	Zinc	Copper	Selenium	Iodine
	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
0-3 months	525	400	55	210	800	320	1.7	4	0.2	10	50
4-6 months	525	400	60	280	850	400	4.3	4	0.3	13	60
7-9 months	525	400	75	320	700	500	7.8	5	0.3	10	60
10-12 months	525	400	80	350	700	500	7.8	5	0.3	10	60
1-3 years	350	270	85	500	800	800	6.9	5	0.4	15	70

Table 4: Vitamins daily nutrient requirements during infancy (SACN 2019)

Age	Thiamin	Riboflavin	Niacin	Vitamin B6	Vitamin B12	Folate	Vitamin C	Vitamin A	Vitamin D
	mg/d	mg/d	mg/d †	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
0-3 months	0.2	0.4	3	0.2	0.3	50	25	350	8.5-10***
4-6 months	0.2	0.4	3	0.2	0.3	50	25	350	8.5-10***
7-9 months	0.2	0.4	4	0.3	0.4	50	25	350	8.5-10***
10-12 months	0.3	0.4	5	0.4	0.4	50	25	350	8.5-10***
1-3 years	0.5	0.6	8	0.7	0.5	70	30	400	10

Childhood

During pre-puberty, children's growth occurs a relatively consistent rate of about 6 cm per year. The weights of the boys and girls are also similar until the age of 10 years old (Alimujiang 2018). However, individuals may show considerable variation because some children grow faster than others. Even in childhood boys tend to have a slightly increased lean muscle mass and lower proportion of body fat than girls. The requirements for energy and macronutrients differ according to the body size and composition, growth rate and level of physical activity but in most societies the provided dietary guidelines are followed. A specific aspect to consider of nutritional recommendations within childhood is the intake of sugar and saturated/trans fats as the increasing rate of obesity in young children rises and the concern that habitual use of high sugary and fatty foods may lead to a retention of such habits in later life and consequently an increased risk of coronary heart disease, stroke, high blood pressure, obesity and T2DM. Research has shown that high intakes of sugary drinks, biscuits and processed confectionery leads to early acquisition of persisting dietary practices and the beginning of fatty plaques in the arteries at very young ages leading to cognitive decline, obesity, insulin sensitivity and early stages of diabetes (Johnson 2018).

While specific nutrient deficiencies in childhood are widespread throughout the developing world the majority of children in most relatively developed countries can achieve all their nutrient needs by following dietary guidelines

via eating an adequate number of servings from each food group. However, when food restrictions are applied for any reason, a high risk of developing deficiency of one or more nutrient occurs. This also occurs in those that follow strict diets that have not been well planned.

Children who consume 2 to 3 servings of milk and milk products are expected to achieve sufficient calcium intakes for bone and teeth health. True milk allergies are rare and when they do occur usually diminish by the age of three (BNF 2019). For children who do not eat or dislike milk, it is essential that alternatives such as wholegrain cereals, beans, nuts, green vegetables or tofu with added fortification is consumed. Although calcium is present plant-based sources it is reported to be less bioavailable than from dairy foods (Chalupa-Krebsdak 2018).

A number of children are vegans or vegetarians through their own or parental choice. Vegetarian children who consume dairy and eggs can consume the recommended intakes of energy and essential nutrients. However, children following a vegan diet may have considerable difficulty in achieving sufficient energy and sufficient amounts of nutrients such as vitamin B12, iron, calcium and zinc in their diets (Baron 2018). For those following such diets careful planning and sometimes supplementation with additional quantities of essential nutrients is required to assist optimal growth and development.

Table 5: Vitamins daily nutrient requirements during childhood (SACN 2019)

Age	Thiamin	Riboflavin	Niacin	Vitamin B6	Vitamin B12	Folate	Vitamin C	Vitamin A	Vitamin D
	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
4-6 years	0.7	0.8	11	0.9	0.8	100	30	400	10
7-10 years	0.7	1	12	1	1	150	30	500	10

Table 6: Vitamins daily nutrient requirements during childhood (SACN 2019)

Age	Calcium	Phosphorus ¹	Magnesium	Sodium	Potassium	Chloride	Iron	Zinc	Copper	Selenium	Iodine
	mg/d	mg/d	mg/d ²	mg/d ³	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
4-6 years	450	350	120	700	1100	1100	6.1	6.5	0.6	20	100
7-10 years	550	450	200	1200	2000	1800	8.7	7	0.7	30	110

Children of school age are often provided with a school lunch or the choice for a packed lunch. Schools have to abide to the Food Provision, where they are encouraged to provide healthy food throughout the day to promote a consistent message about healthy eating to children (Addis 2019). This means schools and other food served throughout the day should be nutritious and of good quality. Government regulations apply to comprehensive schools and are also followed by many private education schools to provide healthy balanced meals based on the eat well guide (Public Health Wales 2019). Until the age of five children are offered milk free of charge within England and Wales with a choice thereafter at a fee.

Adolescence

Biologically, adolescence is the time of life where growth is completed, and individuals become sexually mature. Timing of the growth spurt and the onset of sexual function which both occur at the start of adolescence vary considerably between individuals. Between the ages of 10 to 20 years lean body mass will increase from an average 25 to 63 kg in boys, and 22 to 42 kg in girls. Body fat also increases from an average of 7 to 9 kg in boys and from 5 to 14 kg in females. Total body calcium goes from approximately 300 g in both boys and girls to over 1000 g in boys and 750 g in girls (Sanford 2019).

During adolescence social influences become particularly dominant and can play a major role over what food choices are made and what is eaten. Ideals of body image can also be presented and the pressure to consume alcohol or experiment with recreational drugs. This is often a time where interest is not focused on the nutritional aspects of food but more the following peers, following fads or adopting personal restrictions. It is also a time of rebellion where it is felt the need to adopt different food habits from their parents (Dana 2015).

In girls the growth spurt is usually around aged 12 and peak energy intakes have been recorded between 11 to 18 years old. In boy's peak height velocity is usually around 14 years and the highest intakes have been recorded between 13 and 18 years old (Jai 2017). Only a small proportion of the extra food is needed to provide the energy for growth, which is estimated to be 6 kcal per gram of weight gain corresponds to in about 1% of energy intake at 15 years. Extra energy is in some cases is used for the increased high level of activity (Pauling 2019). However, there is a tendency in under exercise in adolescents (both male and female) to overeat therefore becoming highly susceptible to increased fat mass.

Table 7: Vitamins daily nutrient requirements during adolescence (SACN 2019)

Age	Thiamine	Riboflavin	Niacin	Vitamin B6	Vitamin B12	Folate	Vitamin C	Vitamin A	Vitamin D
Males	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
11-14 years	0.9	1.2	15	1.2	1.2	200	35	600	10
15-18 years	1.1	1.3	18	1.5	1.5	200	40	700	10
Females	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
11-14 years	0.7	1.1	12	1	1.2	200	35	600	10
15-18 years	0.8	1.1	14	1.2	1.5	200	40	600	10

Table 8: Mineral daily nutrient requirements during adolescence (SACN 2019)

Age	Calcium	Phosphorus ¹	Magnesium	Sodium	Potassium	Chloride	Iron	Zinc	Copper	Selenium	Iodine
Males	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
11-14 years	1000	775	280	1600	3100	2500	11.3	9	0.8	45	130
15-18 years	1000	775	300	1600	3500	2500	11.3	9.5	1	70	140
19-50 years	700	550	300	1600	3500	2500	8.7	9.5	1.2	75	140
50+ years	700	550	300	1600	3500	2500	8.7	9.5	1.2	75	140
Females	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	Mg/d	µg/d	µg/d
11-14 years	800	625	280	1600	3100	2500	14.85	9	0.8	45	130
15-18 years	800	625	300	1600	3500	2500	14.85	7	1	60	140

Among adolescent’s iron is commonly deficient with an increased susceptible of iron deficiency anaemia due to increased blood volume and muscle mass during growth and development. This raises the need of iron for building up haemoglobin to transport oxygen and the related protein myoglobin in muscle. In females the need for increased iron is elevated by the beginning of menstruation which will maintain an increased need until menopause (Beard 2000). Iron rich foods such as meats, fish, beans dark green vegetables nuts and iron fortified cereals are good sources. Iron from animal foods have a higher bioavailability than that from non-animal sources and fortified foods. During adolescence new dietary strategies are often followed such as vegetarianism and therefore an increased risk of iron deficiency is present and careful consideration of food sources should be made. There is also the need to maintain vitamin C to help the absorption of non-haem iron from non-animal products.

During adolescence an increased need for calcium is required to meet the needs of the growing skeleton. About 45% of the adult skeletal bone mass is formed during adolescence and therefore it is important that the diet supplies and adequate calcium intake to help build bone density (NIH 2019). The achievement of peak-bone mass during childhood and adolescence is crucial to reduce the risk of osteoporosis later in life; particularly in females. Good dietary sources of calcium are dairy products such as milk, yoghurt and cheese and fortified foods.

As well as a good dietary supply of calcium the need for vitamins and minerals like vitamin D and phosphorus are needed to help support the uptake and regulation of calcium to achieve peak-bone mass. Physical activity is also essential particularly weight-bearing exercise which is the stimulus to build and retain bone density.

Adulthood

During adulthood there is still a requirement to maintain all essential nutrients and to ensure adequate energy is ingested. Females will continue to require more iron than males throughout adult hood until menopause. Females also require to intake enough calcium to maintain bone density and safeguard bone health. Here the need for consistent and well considered food is required to ensure the maintenance of coronary, respiratory and endocrine health is maintained. The biggest concerned for adulthood is obesity (GIG Cymru 2019).

Table 9: Vitamins daily nutrient requirements during adulthood (SACN 2019)

Age	Thiamine	Riboflavin	Niacin	Vitamin B6	Vitamin B12	Folate	Vitamin C	Vitamin A	Vitamin D
Males	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
15-18 years	1.1	1.3	18	1.5	1.5	200	40	700	10
19-50 years	1	1.3	17	1.4	1.5	200	40	700	10
50+ years	0.9	1.3	16	1.4	1.5	200	40	700	10
Females	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
15-18 years	0.8	1.1	14	1.2	1.5	200	40	600	10
19-50 years	0.8	1.1	13	1.2	1.5	200	40	600	10

Table 10: Mineral daily nutrient requirements during adulthood (SACN 2019)

Age	Calcium	Phosphorus1	Magnesium	Sodium	Potassium	Chloride4	Iron	Zinc	Copper	Selenium	Iodine
Males	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
15-18 years	1000	775	300	1600	3500	2500	11.3	9.5	1	70	140
19-50 years	700	550	300	1600	3500	2500	8.7	9.5	1.2	75	140
50+ years	700	550	300	1600	3500	2500	8.7	9.5	1.2	75	140
Females	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
15-18 years	800	625	300	1600	3500	2500	14.85	7	1	60	140
19-50 years	700	550	270	1600	3500	2500	14.85	7	1.2	60	140

The Diet and Nutrition Survey (DNDS), indicated that males met the recommended need for portions of fruit and vegetables per day providing an abundance of vitamins and meeting their daily needs. It also revealed that males did not meet the need to eat oily fish of at least one portion (140 g) per week; oily fish such as salmon, mackerel, sardines, trout are all types of long chain fatty acids which help prevent heart disease lower blood pressure and reduced inflammation (DNDS 2016). Oily fish is also a good source of vitamin D. Red meat is a good source of protein and provides a range of minerals and vitamins such as iron and zinc and vitamins a. However, the consumption of processed meats is associated with an increased risk of bowel cancer, heart disease and diabetes. The DNDS indicated that males consumed an average 100grams of processed meat per day. The average intake of salt and adult male is reported to be 9.1 g per day which is much higher than the recommended 6 g per day. The high intake of salt and processed meats is associated with heart disease, heart attacks, stroke, heart failure, kidney disease and vascular dementia (NHS 2019).

For females the DNDS data suggested that females with in the UK met the need for vitamins but did not meet the requirements of all minerals, often falling short iron. The results predicted that 75% of all woman may have inadequate iron intakes. Low iron intakes increase the risk of iron deficiency anaemia. Females also fell short with calcium, where intakes are particularly important for maintaining bone health (NHS 2019).

The intake of oily fish is particularly useful within females due to the omega3 fatty acids to maintain cell integrity, maintain heart health and maintain neurological health.

For males and females that are vegan or vegetarian an omega 3 supplement or addition of Chia seeds, flaxseeds or hemp oil is recommended to increase omega 3 intake (Pauling 2019).

The diet survey presented results that females were over consuming, by double the amount of recommended sugar intake per day this was mainly ingested through sweetened drinks fruit juice, sugar preserves and confectionery, cereals and cereal products.

Seniors

In ageing adults, it is common to see a reduction in lean body mass and slowing of the metabolic rate either derived from a reduced amount of physical activity, loss of appetite and natural decline. Elderly persons require less energy than adults due to reduced energy output however complete nutrient intake is essential. Increased difficulty in consuming adequate nutrition can be presented via age-related disease or impairments such as oral health restricting the ability to chew, swallow, inhibited digestion and malabsorption of nutrients (Kossioni 2018).

Nutrient status may also be further affected by decreased production of digestive enzymes and changes within cell function within the gut lining, bowel and stomach (CDC 2019). Consideration also need to be made for drug-nutrient interactions for those taking regular medication (NHS 2019). Nutritional interventions such as liquidising foods or having nourishing drinks are important to enable nutrient uptake and an introduction of supplementation may be needed. However, over supplementing can have a negative effect by suppressing the uptake of other nutrients (Maginin 2018).

Table 11: Vitamins daily nutrient requirements for seniors (SACN 2019)

Age	Thiamine	Riboflavin	Niacin	Vitamin B6	Vitamin B12	Folate	Vitamin C	Vitamin A	Vitamin D
Males	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
50+ years	0.9	1.3	16	1.4	1.5	200	40	700	10
Females	mg/d	mg/d	mg/d	µg/d	µg/d	mg/d	mg/d	µg/d	µg/d
50+ years	0.8	1.1	13	1.2	1.5	200	40	600	10

Table 12: Mineral daily nutrient requirements for seniors (SACN 2019)

Age	Calcium	Phosphorus1	Magnesium	Sodium	Potassium	Chloride4	Iron	Zinc	Copper	Selenium	Iodine
Males	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
50+ years	700	550	300	1600	3500	2500	8.7	9.5	1.2	75	140
Females	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	mg/d	µg/d	µg/d
50+ years	700	550	270	1600	3500	2500	8.7	7	1.2	60	140

It is important that older adults meet their protein requirements to maintain muscle mass and prevent sarcopenia that often leads to metabolic diseases, falls and body weakness (Young 2018). It is also important to ensure that calcium requirements are met to maintain bone health; this is particularly important in females who are susceptible to osteoporosis due to decreasing bone density post menopause (Kelasi 2018)

Age can cause decreases in appetite and thirst sensation, which leads older adults to be susceptible to becoming dehydrated. It is especially important to ensure that water is consumed, and that alcoholic beverages, tea or coffee are reduced as these can further suppress the appetite and are diuretics (Cramer et al 2019). Early signs of dehydration include dizziness, tiredness and headaches. Long-term mild dehydration increases the risk of kidney stones, constipation and high cholesterol as well as diminished physical and mental well-being.

Product considerations

It is important for individuals to be educated on their nutritional needs and to aid the ability to identify food ingredients that maybe particularly beneficial or harmful to health. Food manufacturers must consider average nutrient intakes collated, along with SACN/UK dietary recommendations when formulating products for either general or age-specific populations to aid nutritional intake. Formulations of food and food products must consider consumer lifelong food habits. Whilst this is a challenge it presents rewards from gaining consumer confidence.

The nutritional composition of a product is fast becoming the determining factor of purchase within the increasingly health conscious consumer. Consumers indicate that they will pay more for foods or products containing high quality ingredients with a health benefit or function (Cargill 2019).

Muscle building powders and recovery shakes once directed at the sports market have bridged over to the 'healthy aging category'. The smooth mixture and bio-availability of the ingredients lend themselves to cross over to alternative markets with great success. The use of supplementary formulas targeted at the older consumer who is struggling to consume adequate nutrition or has lost the ability to chew can provide a great nutrient support, however products designed for the aging adults face the challenge of marketing to engage with the consumer.

Summary

Throughout life stages energy and micronutrient requirements change yet all nutrients are essential at all life stages. Whilst dietary insufficiency of micronutrients is of great concern they can be addressed with corrected nutritional intakes. The greater problem presenting itself is dietary excesses; particularly energy, sugar, refined carbohydrates and saturated fats which are fuelling the current epidemics of obesity and chronic noncommunicable disease. The need for personal and cultural change is considered to be the biggest factor to steer the population to good health to create 'good' innate habits from a young age.

Appendix 1;

Estimated Average Requirements for children

Age (years)	MJ/d	kcal	MJ/d	kcal
4	5.8	1386	5.4	1291
5	6.2	1482	5.7	1362
6	6.6	1577	6.2	1482
7	6.9	1649	6.4	1530
8	7.3	1745	6.8	1625
9	7.7	1840	7.2	1721
10	8.5	2032	8.1	1936
11	8.9	2127	8.5	2032
12	9.4	2247	8.8	2103
13	10.1	2414	9.3	2223
14	11	2629	9.8	2342
15	11.8	2820	10	2390
16	12.4	2964	10.1	2414
17	12.9	3083	10.3	2462

Estimated Average Requirements for adults

Age (years)	MJ/d	kcal MALE	MJ/d	Kcal FEMALE
19-24	11.6	2772	9.1	2175
25-34	11.5	2749	9.1	2175
35-44	11	2629	8.8	2103
45-54	10.8	2581	8.8	2103
55-64	10.8	2581	8.7	2079
65-74	9.8	2342	7.7	1912
75+	9.6	2294	8.7	1840

References

- Addis, S., & Murphy, S. (2019). 'There is such a thing as too healthy!' The impact of minimum nutritional guidelines on school food practices in secondary schools. *Journal of human nutrition and dietetics*, 32(1), 31-40.
- Agostoni, C., Guz-Mark, A., Marderfeld, L., Milani, G.P., Silano, M. and Shamir, R., (2019). The Long-Term Effects of Dietary Nutrient Intakes during the First 2 Years of Life in Healthy Infants from Developed Countries: An Umbrella Review. *Advances in Nutrition*, 10(3), pp.489-501.
- Akhtar, S., Ismail, T., Zafar, S., Wahid, M., & Gilani, S. A. (2019). Vitamin D status among female university students in Pakistan. *Progress in Nutrition*, 21(2), 327-332.
- Alimujiang, A., Colditz, G. A., Gardner, J. D., Park, Y., Berkey, C. S., & Sutcliffe, S. (2018). Childhood diet and growth in boys in relation to timing of puberty and adult height: the Longitudinal Studies of Child Health and Development. *Cancer Causes & Control*, 29(10), 915-926.
- Baroni, L., Goggi, S., Battaglini, R., Berveglieri, M., Fasan, I., Filippin, D., ... & Battino, M. (2019). Vegan nutrition for mothers and children: Practical tools for healthcare providers. *Nutrients*, 11(1), 5.
- Beard (2000) <https://www.ncbi.nlm.nih.gov/pubmed/10721923>
- Boeing et al (2016) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4848697/>
- CDC (2019) <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-weight-gain.htm>
- Certin (2016) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5084016/>
- Chalupa-Krebszdzak, S., Long, C. J., & Bohrer, B. M. (2018). Nutrient density and nutritional value of milk and plant-based milk alternatives. *International dairy journal*.
- Dana (2015) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4554432/>
- DNDS (2019) <https://www.gov.uk/government/collections/national-diet-and-nutrition-survey>
- Drink Aware (2019) <https://www.drinkaware.co.uk/alcohol-facts/health-effects-of-alcohol/fertility-and-pregnancy/is-alcohol-harming-your-fertility/>
- Jai (2017) <https://nyaspubs.onlinelibrary.wiley.com/doi/full/10.1111/nyas.13330>
- Johnson, D. (2018). The Obesity Epidemic.
- Kearney, J. (2010). Food consumption trends and drivers. *Philosophical transactions of the royal society B: biological sciences*, 365(1554), 2793-2807.
- Kelasi, P. S. A., & Jain, A. R. (2018). Oral health status and prosthetic needs in elderly patient of Chennai resident. *Drug Invention Today*, 10(5).
- Kossioni, A. (2018). The Association of poor oral health parameters with malnutrition in older adults: A review considering the potential implications for cognitive impairment. *Nutrients*, 10(11), 1709.
- Maggini, S., Pierre, A., & Calder, P. (2018). Immune function and micronutrient requirements change over the life course. *Nutrients*, 10(10), 1531.
- Mayo clinic (2019) <https://www.mayoclinic.org/diseases-conditions/male-infertility/symptoms-causes/syc-20374773>
- NHS (2019) <https://www.nhs.uk/news/pregnancy-and-child/new-weight-advice-for-pregnancy/>
- NIH (2019) <https://www.nichd.nih.gov/health/topics/bonehealth/conditioninfo/children>
- Pauling (2019) <http://www.faqs.org/nutrition/Biographies/Pauling-Linus.html>

Peña-Rosas, J. P., & Viteri, F. E. (2009). Effects and safety of preventive oral iron or iron+ folic acid supplementation for women during pregnancy. *Cochrane database of systematic reviews*, (4).

Public health wales (2019) <http://www.wales.nhs.uk/sitesplus/888/page/43758>

SACN (2019) [https://www.nutrition.org.uk/attachments/article/234/Nutrition%20Requirements Revised%20Oct%202016.pdf](https://www.nutrition.org.uk/attachments/article/234/Nutrition%20Requirements%20Revised%20Oct%202016.pdf)

Sahebkar-Khorasani, M., Jarahi, L., Cramer, H., Safarian, M., Naghedi-Baghdar, H., Salari, R., ... & Azizi, H. (2019). Herbal Medicines for Suppressing Appetite: A Systematic Review of Randomized Clinical Trials. *Complementary therapies in medicine*.

Sanford (2019) <https://www.stanfordchildrens.org/en/topic/default?id=the-growing-child-adolescent-13-to-18-years-90-P02175>

Sozach (2011) <https://www.ncbi.nlm.nih.gov/pubmed/22516697>

Wahlqvist, M.L., Krawetz, S.A., Rizzo, N.S., Dominguez-Bello, M.G., Szymanski, L.M., Barkin, S., Yatkin, A., Waterland, R.A., Mennella, J.A., Desai, M. and Ross, M.G., (2015). Early-life influences on obesity: from preconception to adolescence. *Annals of the New York Academy of Sciences*, 1347(1), p.1.

WHO (2019) <https://www.who.int/nutrition/topics/obesity/en/>

Young, V. R., Gersovitz, M., & Munro, H. N. (2018). Human aging: protein and amino acid metabolism and implications for protein and amino acid requirements. *Nutrients* 3.(3)