Medications & Nutrition Overview

by Yvonne Coleman, 2021

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Introduction

Icebergs are an excellent metaphor for our knowledge of the effects of medications on nutritional health – we're aware of their existence, but we don't really know the size of the underwater or "hidden" component.

Medications can both affect our nutritional status and be affected by various foods, nutrients and our nutritional health. This overview will briefly address some of these aspects.

The terms "drugs", "medicines" and "medications" are used interchangeably.

How Medications Affect Nutrition

Medications can affect nutrition at many points.

Alteration To Food Intake

Food intake can be affected both directly and indirectly:

- the primary direct effects are either increased or decreased appetite
- indirect effects include side effects such as nausea, constipation, dry mouth

Consequences of the side effects are to include:

- change in food intake to include or exclude certain foods
- refusal to eat
- use of over-the-counter drugs (OTCs) for relief of symptoms
- refusal to take the drugs

Altered food intake and the consequences of side effects can seriously compromise the general well-being of the consumer.

Alteration to Nutrient Absorption

Nutrient absorption can be affected by both direct and indirect mechanisms of interference:

- the primary direct mechanisms are related to inhibition of absorption of nutrients by drugs eg carbamazepine competitively inhibits the absorption of biotin and pantothenic acid
- indirect mechanisms include:
  - **Altered nutrient absorption due to altered gut pH**

    Some nutrients are pH sensitive for absorption, and altered pH will alter their absorption, for example maximal folate absorption is pH 6.0-6.2 and there is no absorption at pH 7.0.

  - **Bacterial overgrowth**

    As gut pH increases, gut microflora survive further up the GI tract, and access nutrients before the host, resulting in reduced availability of nutrients for absorption by the host/person.

  - **Interruption to the function of physiological transporters**

    Mechanisms of interruption to the physiological transporters, now commonly referred to as "drug transporters" can be by inhibition or by displacement. Early evidence indicates many commonly prescribed medications can interrupt the transporters.

Alteration To Nutrient Metabolism

Some drugs alter nutrient metabolism and thus alter nutrient requirements. For example phenytoin increases the metabolism, and therefore the requirements, of vitamins D, K, and folate.

Some drugs inhibit the conversion of a vitamin to its active form, and may therefore cause a resultant deficiency eg isoniazid and vitamin B6.

Alteration To Nutrient Excretion

Nutrient excretion can be increased or decreased

- **Increased excretion**
  eg frusemide and magnesium
- **Decreased excretion**
  eg thiazide diuretics and calcium, which has a positive effect on bone health

Polypharmacy Effect?

The degree of effect of polypharmacy (multiple medications) on the status of vitamins and minerals is difficult to ascertain. Some unanswered questions:

- is nutrient depletion dose dependent?
- is the depletion additive, synergistic, a combination?. Evidence is now starting to show both mechanisms
- is there an adaptive response?
- if there is an adaptive response then at what point does the adaptation cease and irreversible change commence?
- are some of the debilitating effects in the elderly due to sub-clinical or overt clinical mal-nutrition?

There is a continuum of nutrient depletion from reversibility to irreversibility. A classic example is thiamine deficiency in those who are frequent consumers of ethanol-based beverages. Ethanol intake is associated with decreased thiamine availability. Initial thiamine deficiency manifests as Wernickes syndrome and is reversible with appropriate thiamine intervention, however if the deficiency is not addressed then there is progression to Korsakoff's Psychosis which is essentially irreversible even with thiamine intervention.

The clinical manifestations of drug-induced adverse reactions - anaemia, diarrhoea, weight loss, etc - are often attributed to the underlying disease and may in fact be a consequence of some of the prescribed medicines.

Nutritional Factors That Alter the Effects of Medications

Medications can affect nutrition at many points.

The presence of food in the gut

Likely to alter factors such as gastric secretion, GI motility, gut transit time.

Recent changes in diet

Actions can be voluntary or involuntary:

- **Voluntary changes**
  - philosophical beliefs such as vegetarianism
  - dietary change for pragmatic reasons such as health benefits eg reduced salt intake may alter the necessity or dose of some drugs
- **Involuntary changes**
  - new diagnosis necessitating significant dietary change eg coeliac disease
  - change in domicile such as from home to residential care – results in altered meal provision – type of food consumed, serving times of meals, meal split eg whether the main meal is served at the midday or evening meal, etc

Malnutrition

The plasma proteins are typical indicators of nutritional status and are generally reduced in malnutrition. If there is ≥ 90% binding of drug to plasma proteins, then it is likely the plasma proteins are the primary transporters for those drugs. Inadequate protein status may result in altered drug availability and consequently altered therapeutic effect(s) and possible exacerbation of side effects - for example INR is significantly altered by hypoproteinaemia.

Weight change

Some drug dose calculations include weight directly; more commonly weight is included in the calculation of renal function. Change in weight may necessitate change in drug dose for example a loss of weight will result in increased thyroxine effect and a gain in weight will result in reduced thyroxine effect – in both cases thyroxine dose may require adjustment.

Food-drug interactions

The interactions between foodstuffs and prescribed medicines can be very complex and our understanding of both complexity and mechanisms of action are steadily increase. Some examples are outlined:

- **Negative interactions include**
  - the stimulatory effect of caffeine opposes the effect of sedatives
  - intermittent intake of grapefruit products alters the effectiveness of a range of drugs
- **Positive interactions include**
  - regular daily intake of grapefruit products – which generally means lower drug dose and therefore fewer adverse reactions
  - a low salt diet which may result in decreased dose for a range of drugs
- **Foods may alter urinary pH**
  - which can alter the half-life of some drugs. Foods such as milk, vegetables and citrus fruits can alkalinize the urine; and meats, fish, cheeses and eggs can acidify the urine

Nutrient-drug interactions

Concurrent administration of a range of drugs with mineral supplements is likely to decrease the availability of both drugs and mineral supplements. For example iron binds with thyroxine resulting in reduced availability of both drug and nutrient - if administered at different times from each other then the risk of interaction is minimal.

Nutrient supplements can also affect drug utilisation. For example pyridoxine can reverse the anti-parkinsonism effect of levodopa, and vitamin K counteracts the anticoagulant effect of warfarin.

Nutritional factors can have a profound impact on the overall effectiveness of prescribed medicines.

Strategies to Manage Some Interactions

Strategies can be developed to utilise the positive interactions and manage the negative interactions, and could include:

- **A low salt diet**

  not adding salt during cooking, and choosing low salt products (< 120 mg sodium (Na)/ 100 g product).

- **A caffeine-free period**

  in order to minimise caffeine-stimulatory effect on prescribed sedatives and sleep, advisable to initiate a policy for a caffeine-free period after the evening meal.

- **Mineral-containing supplements**

  in order to minimise nutrient-drug interactions, advisable to initiate a policy that mineral-containing supplements be administered at a different time from most prescribed medicines; for example midday seems to be a low drug administration time.

- **A sunshine policy**

  sunshine increases vitamin D uptake and melatonin availability. Vitamin D is associated with an improvement in health factors such as bone health, and reduced risk of falls; melatonin is particularly associated with regularising the circadian rhythm and therefore improved sleep patterns.

- **Stop dates for nutrient supplements**

  this has particular relevance for mineral supplements because long term nutrient supplements may interfere with the status of other nutrients that share the same absorption mechanism. For example, because they share the same absorption mechanism excessive zinc intake can decrease copper status and result in a myeloneuropathy.

Conclusion

The potential for drugs to affect nutritional health, and for nutritional factors to impact on drug action is steadily gaining recognition. Drugs can significantly affect the intake, absorption, metabolism and excretion of nutrients. Drug effect can be significantly affected by factors such as malnutrition, voluntary or involuntary change in diet, and nutrient supplements. The interactions can be both positive and negative.

The inclusion of the effects of drugs on nutritional factors in the clinical management of the people in our care can only enhance their outcomes/responses and consequently their overall well-being. Although there are many issues that require further research, there is sufficient knowledge for application in the clinical setting today.

Similarly to climate change diminishing real ice bergs, scientific evidence is steadily diminishing the lack of knowledge and understanding of our metaphorical ice bergs relating to prescribed medicines and nutritional health.

The impact of prescribed medicines on nutritional health is an overlooked bit in health care - the evidence of the benefits conferred when included in care management is steadily increasing however clinician inclusion in day-to-day clinical practice remains limited.

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