

MedNut Mail

The How, When, Where, Which and Why of pharmacotnutrition

Acid-base balance and pharmaconutrition

Y Coleman

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<https://medicationsandnutrition.online>

Commentary

Acid-base imbalance is now being associated with a range of Western health disorders including insulin resistance, diabetes, thyroid function resistance, osteoporosis, altered osteoclast and osteoblast activity, heart disease, hypertension, albuminuria, impaired renal function, chronic kidney disease, recurrent nephrolithiasis, impaired growth in children, and increased body fat in children, etc.

Similar to steady state concentration, acid-base balance is achieved when intake and production are equal to excretion.

The main sources of acid intake are mostly animal foods and salt, and the main sources of base intake are mostly plant foods, calcium, magnesium and potassium. Increased dietary acid load is associated with many factors including dietary salt intake and/or low fruit and vegetable intake. There is evidence that increasing fruit and vegetable intake will modify the acid effect of animal proteins.

The body's regulatory mechanisms are unable to maintain steady state levels with diet acid loads $> \sim 1$ mmol/kg/day. Typical western diets produce approximately 1 mmol dietary acid/kg/day which means most people

are already near their threshold for retaining acid.

An optimal urinary pH is about 6.8 – 7.0 which signifies a net acid excretion of approximately zero; a urinary pH of ≤ 6.5 can indicate low-grade acidosis. Kidney function usually starts to decline from early adulthood ie age about 20 at a rate of 1%. Steady state acid levels have been shown to increase with ageing and with decreasing renal function.

When renal acid excretion capacity is impaired, a lower urinary pH is necessary for excretion of the same amount of acid ie urinary pH and net acid excretion (NAE) are inversely correlated.

It now seems that those with -

- **good renal function** - are better able to maintain their blood pH at the high end of normal range (7.35 – 7.45). Urinary acid levels > 1 mmol/kg/day means acid retention occurs even with normal kidney function and so a typical western diet is likely to be borderline;
- **diminishing renal function** - can only maintain their blood pH at the low end of normal range and is indicative of acidosis. Retention of only 1 - 2 mmol acid/day is cumulative.

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What should we consider in our clinical practice in relation to potentially increasing acid-base balance –

- identify prescribed medications that negatively impact calcium, magnesium and potassium status and recommend interventions to minimise their negative impact on acid-base balance?
- specifically identify those with diminishing renal function and clarify whether any of their prescribed medications alter acid-base balance status?

- review the excipients (ingredients) of prescribed medications for their salt content?

Conclusions

Altered acid-base balance causes significant physiological harm however direct and indirect pharmaconutrition impacts may be difficult to establish especially given the nascent stage of research in this area.

Case study

Medical History with Nutritional Aspect

Amputation	<input type="checkbox"/>	Constipation	<input type="checkbox"/>	Dysphagia	<input type="checkbox"/>	MND	<input type="checkbox"/>
Anaemia	<input type="checkbox"/>	CVA	<input checked="" type="checkbox"/>	Enteral Feed	<input type="checkbox"/>	MS	<input type="checkbox"/>
Arthritis	<input checked="" type="checkbox"/>	CVD	<input type="checkbox"/>	Falls	<input checked="" type="checkbox"/>	Osteoporosis	<input type="checkbox"/>
Cancer	<input checked="" type="checkbox"/>	Dementia	<input type="checkbox"/>	Fracture	<input type="checkbox"/>	PD	<input checked="" type="checkbox"/>
CCF	<input type="checkbox"/>	Dentures	<input type="checkbox"/>	Frailty	<input type="checkbox"/>	Pressure Area	<input type="checkbox"/>
Chest Infection	<input type="checkbox"/>	Depression	<input checked="" type="checkbox"/>	Gout	<input type="checkbox"/>	Renal	<input type="checkbox"/>
COAD	<input type="checkbox"/>	DM Type 1	<input type="checkbox"/>	Hypertension	<input type="checkbox"/>	Ulcer	<input type="checkbox"/>
Confusion	<input type="checkbox"/>	DM Type 2	<input type="checkbox"/>	Incontinent	<input checked="" type="checkbox"/>	UTI	<input type="checkbox"/>
Food Allergies	<input type="text" value="dyskinesia"/>						
Other:	<input type="text" value="legally blind, Ca prostate, epilepsy, pain, GORD"/>						

Biochemistry with Pharmaconutritional Consequences

No recent relevant results available

Medications That May Adversely Affect Nutritional Status

Drug	Vits + Mins	bpp >90%	N/V	C/D	Wt	App	Tst	Thir	Sal	Drig	d m	Dys	BSL
Aspirin	C, Fe	<input checked="" type="checkbox"/>	NV								<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
COLOXYL WITH S		<input type="checkbox"/>		D							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPILIM	B12, B6, biotin, Ca, carnitine, I	<input checked="" type="checkbox"/>	NV	CD	↑	↕					<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Frusamide	(20 mg/day) Ca, Cl, K, Mg, Na,	<input checked="" type="checkbox"/>	NV	CD		↓					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Mirtazapine		<input type="checkbox"/>	N	D	↑	↑					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oxazepam		<input checked="" type="checkbox"/>	N						↕		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PANADOL		<input type="checkbox"/>	NV	CD							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risperidone		<input checked="" type="checkbox"/>	NV	C	↑				↑		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extra drug:	<input type="text" value="zinc"/>												

Summary of medications and nutrients

Organ (transporter)	Thiamine	Choline	Carnitine
Inhibitor function			
Liver (OCT1)	Risperidone	Risperidone	
Into kidneys (OCT2)	Mirtazepine Oxazepam Risperidone	Mirtazepine Oxazepam Risperidone	

Comments – medication and nutrition impacts (direct and indirect) only

Biochemistry

No recent relevant biochemistry available. Advisable to check plasma proteins (albumin, total proteins) as they are the primary transporters for five of the prescribed drugs and hypoproteinaemia may alter their effects and side effects.

Aspirin plus vitamin C (960 mg/day) attenuates drug-induced gastric damage and restores anti-oxidant protection.

Chronic use of coloxyl + senna may promote excessive loss of water and electrolytes, especially potassium, and their regular monitoring recommended.

Glycaemia

Currently prescribed 4 medications that may alter glycaemia, being aspirin, Epilim, frusemide, risperidone.

Epilim decreases biotin and carnitine absorption and decreases availability of folate and vitamin D.

Frusemide increases urinary excretion of calcium, magnesium, potassium and sodium.

Pharmaconutrition

Currently prescribed 7 medications that include nausea as a side effect.

Dietary levels of caffeine intake in conjunction with paracetamol inhibit antinociception.

Currently prescribed 5 medications that include nausea, vomiting and constipation as side effects.

Concurrent ingestion of paracetamol and iron resulted increased rate of iron absorption and decreased extent of drug absorption; the authors advise drug and iron to be administered at different times from each other.

Currently prescribed 4 medications that include anaemia and hyperglycaemia as side effects.

Regular monitoring sodium levels recommended whilst mirtazepine prescribed.

Vitamin C (960 mg/day) attenuates aspirin-induced gastric injury.

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Longterm administration of zinc may cause copper deficiency.

Zinc intervention was commenced 4 months ago - advisable to check status and if > 12 nmol/L then advisable to cease intervention.

Bowel management

- regular aperient prescribed,
- oral PRN aperients prescribed; administered 2 x Mar, 1 x Feb,
- no Nurse Initiated interventions administered

Staff comments

Staff advise Mrs ACD only sits at the table for a short time before she starts walking again.

Observations

Mrs ACD was in her room when we went to speak to her - I escorted her to a table in the Dining Room and seated her at a table - within 10 seconds she had removed herself from the table and walked out of the Dining area, and has continued to walk ever since.

Mrs ACD has steadily lost weight for the last 6 months.

Assessment

Mrs ACD's weight loss is due to many factors including the many side effects of her prescribed medication negatively impacting food intake (dry mouth, altered taste, altered bowel status).

Mrs ACD's diagnoses include chronic pain - nutritional factors that may be useful to consider in pain management include -

- low B12 exacerbates elevated TNF- α which is an inflammatory response marker; elevation of the inflammatory response can include a pain response and currently prescribed Epilim therefore advisable to check B12 status. There is disagreement between pathology ranges and research findings with regard to appropriate B12 levels - neuro-imaging research indicates B12 interventions are effective once levels are less than 300 pmol/L.

- magnesium – proposed mechanism magnesium blocks the NMDA receptor channels in the spinal cord and thus limits the influx of calcium ie reduces the risk of excitotoxicity and consequent exacerbation of pain. Currently prescribed Epilim and frusemide which decreases magnesium absorption.

Mrs ACD's diagnoses include falls - nutritional factors that may be useful to consider in falls management include -

- low B12 – important in the righting reflex; currently prescribed Epilim therefore advisable to check B12 status;

- zinc – can decrease food intake through altered sense of taste and poor appetite, and consequently reduced muscle mass; currently

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prescribed Epilim and frusemide therefore advisable to clarify zinc status;

- magnesium – is important in vitamin D activation and can cause muscle weakness and consequently falls; currently prescribed Epilim and frusemide therefore advisable to clarify magnesium status;

- vitamin D - can cause muscle weakness and consequently falls;

currently prescribed Epilim therefore advisable to clarify vitamin D status.

Mrs SCD's diagnoses include incontinence - nutritional factors that may be useful to consider in incontinence management include - currently

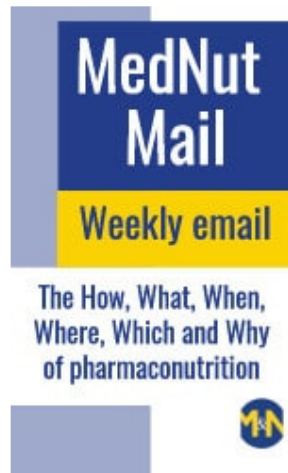
- low B12 – important in the righting reflex and prescribed Epilim therefore advisable to check B12 status.

What else would you include?

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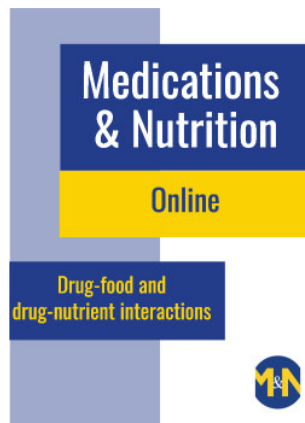
Medications have profoundly and positively changed health outcomes however they do generally come with some nutritional harms. By identifying and addressing the nutritional harms, optimal health outcomes are closer to being achieved.

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