



February 4, 2011

Mr. Tim Blakley
Manager, Legislative & Regulatory Projects Unit
Ministry of Health and Long-Term Care
Health Professions Regulatory Policy and Programs Branch
56 Wellesley St., 12th Floor
Toronto, ON M5S 2S3

Dear Mr. Blakley,

Enclosed is the final list of lab tests that the College of Dietitians of Ontario (CDO) is proposing for Registered Dietitians (RDs) to order in the course of assessing, treating and monitoring nutrition conditions and nutrition-related diseases. The list of lab tests has now been approved by the CDO Council.

The list includes lab tests that RDs currently use and rely upon for nutritional assessment and monitoring across all areas of clinical dietetic practice. Each listed test is accompanied by a corresponding rationale that states the purpose of the test within the context of dietetic practice and how RDs would modify the nutrition care plan based on the lab tests results.

The submission is organized under the following headings covering common nutrient categories and chronic diseases seen within dietetic practice:

- Vitamins
- Minerals
- Electrolytes
- Hematology
- Kidney Disease
- Liver Disease
- Pancreatic Disease
- Cardiovascular Disease
- Diabetes
- Eating Disorders
- Food Allergies/Intolerances
- Miscellaneous

This submission resembles the preliminary draft list provided as a courtesy to you on January 18, 2011 to expedite your review. We have enhanced the rationale for some of the lab tests and added two lab tests following further consultation with our expert panels. The two additions are: 24-Hour Urinary Lactate to Creatinine Ratio (p. 27) and Plasma Fatty Acids (p. 42).

To the best of our ability, we have provided lab test list codes. We will work with the College of Medical Laboratory Technologists of Ontario to fill in the remaining codes and submit this additional information to the Ministry at the earliest possible opportunity.

Our submission respectfully considers the Ministry's original intention of the intended scope of practice change "to authorize dietitians to order specified laboratory tests as set out in regulation for nutritional assessment and monitoring." The list of tests, therefore, excludes those used for medical diagnostic purposes and only includes labs with a clear rationale for nutrition assessment and monitoring.

We provide the following information to assist you in assessing the impact of RDs ordering lab tests:

- 2155 RDs currently work in front-line clinical practice, in either a full or part-time capacity;
- Of this amount, 1078 RDs provide services in hospitals and the remaining RDs work in long-term care, diabetes education centres, private practice, or primary care settings such as family health teams and community health centres.

It is uncommon for RDs to work across all of areas of clinical dietetic practice. Most RDs work in specific areas (e.g., critical care, oncology, pediatrics, etc.) whereby the lab tests they would use would be specific to the patient population and medical conditions they encounter within their practice.

Lab Test List Development

The College consulted extensively in the development of the list of lab tests. CDO staff met with the College of Medical Laboratory Technologists and the College of Midwives for information and guidance. The College surveyed the broad CDO membership to help identify the lab tests currently used and relied upon for the assessment and management of nutrition and related disorders.

To further expand on the lab test list and rationale, the College recruited 64 RDs to participate in lab test expert advisory panels in 14 clinical practice areas. These expert panels each compiled a list of lab tests and corresponding rationale for their particular area of practice. Panels also commented on the frequency of testing. The College subsequently compiled the panel information into one document as enclosed. We enclose the work of the lab test panels for you to refer to as needed.

CDO's Future Steps

The College will now proceed to develop standards of practice and ongoing education materials to support RDs in their professional responsibilities when ordering lab tests. This will include expectations regarding:

- Accountability for ordering lab tests, including appropriate documentation and referrals;
- Interprofessional collaboration: communicating/sharing lab test results with other members of the health care team;
- Fiscal responsibility to avoid duplication of lab tests and using lower-cost lab tests as appropriate;
- Respecting the controlled act of communicating a diagnosis when providing lab test results to clients.

CDO looks forward to the implementation of this lab test ordering authority to expedite and improve patient-centred care. This will also facilitate better access to information for RDs and others when conducting nutrition assessments, developing treatment plans and monitoring nutrition care progress and outcomes

We greatly appreciate the advice received from you and Melissa Quan to clarify the lab test submission requirements. We recognize that the submission will be subject to extensive review and welcome the opportunity to engage in further discussions. Where you have questions, please contact me so we can provide additional information and/or clarification.

Kind regards,



Mary Lou Gignac, MPA
Registrar & Executive Director

CC: Melissa Quan

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
VITAMINS		
Vitamin A [L260]	<ul style="list-style-type: none"> - Required for adequate vision; absorbed in small intestine. - <i>Gastric bypass surgery</i> patients often encounter changes in fat digestion and malabsorption of fat-soluble vitamins; assessed post-operatively in these patients to determine deficiency and compliance with multivitamin/mineral supplements. - Assessed in combination with iron and copper as deficiencies in these minerals can impair vitamin A levels. - Low levels seen in smokers and patients with <i>Cystic Fibrosis</i>; high levels seen post-surgery in lung transplant patients with <i>Cystic Fibrosis</i>. 	<ul style="list-style-type: none"> - Educate patients on foods containing high vitamin A to increase dietary intake. - Recommend patients take oral vitamin A supplements. - Supplement/adjust vitamin A in EN or PN. - Assess iron and copper levels.
Serum Vitamin B1 (Thiamine) [code]	<ul style="list-style-type: none"> - Thiamine helps the body convert carbohydrates into energy; essential for the functioning of the heart, muscles, and nervous system; absorbed in middle section (jejunum) of small intestine. - As the jejunum is bypassed in some <i>gastric bypass surgeries</i>, malabsorption of thiamine may occur; monitored to identify thiamine deficiencies and compliance of multivitamin supplementation post-operatively. - Monitored to rule-out/prevent Beriberi (a nervous system ailment caused by thiamine deficiency). - Thiamine deficiency seen in patients with excessive alcohol consumption and in breast fed infants whose mother is thiamine deficient. - Patients with folate or protein deficiency often have poor thiamine absorption. 	<ul style="list-style-type: none"> - Educate patients on foods containing high thiamine to increase dietary intake. - Recommend patients take oral thiamine supplements. - Supplement/adjust thiamine in EN or PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Vitamin B3 (Niacin) [code]	<ul style="list-style-type: none"> - Assists in the functioning of the digestive system, skin, and nerves; important for the conversion of food to energy. - Niacin can be used in patients who are not tolerating statins (cholesterol-lowering medications); works by slowing the liver's production of Low-Density Lipoprotein (LDL) (the bad) cholesterol and also raises High-Density Lipoprotein (HDL) (the good) cholesterol. - Deficiencies uncommon; monitored in patients taking niacin supplements for cholesterol management to screen for high levels which can be toxic to the liver. 	<ul style="list-style-type: none"> - Collaborate with physician re: need for (or adjustment to) niacin vitamin supplementation for cholesterol management. - Educate clients on appropriate oral niacin supplementation and dietary sources of niacin to increase intake. - Supplement/adjust in EN or PN.
Serum Vitamin B6 (Pyridoxine) [code]	<ul style="list-style-type: none"> - Required by the body for utilization of energy in food, production of red blood cells, and proper functioning of nerves; absorbed in middle section (jejunum) of small intestine. - As jejunum is bypassed in some <i>gastric bypass surgeries</i>, malabsorption of vitamin B6 may occur. - Monitoring this lab identifies deficiencies and compliance of multivitamin supplementation post-operatively in <i>gastric bypass surgery</i> patients. 	<ul style="list-style-type: none"> - Educate patients on foods containing high vitamin B6 to increase dietary intake. - Recommend patients take vitamin B6 supplements. - Supplement/adjust vitamin B6 in EN or PN.
RBC Folate (Folic Acid/Vitamin B9) [L309, and if requested includes serum folate]	<ul style="list-style-type: none"> - Required to synthesize and repair DNA; a co-factor in biological reactions; especially important during periods of rapid cell division and growth (e.g., in pregnancy to prevent neural tube defects) to produce healthy red blood cells and prevent <i>anemia</i>. - Folate deficiency may also increase homocysteine levels which may elevate risk of cardiovascular disease; folate may be monitored along with homocysteine levels. - Deficiency of folate seen post-operatively in <i>gastric bypass surgery</i> patients and those with congestive heart failure and alcoholism. - Monitored in kidney disease patients on dialysis due to losses in dialysate as well as diabetic patients on Metformin (an oral hypoglycemic agent) as this medication can lower folate levels. - Folate can mask B12 deficiency; folate often checked in collaboration with serum vitamin B12 (or Methylmalonic Acid (see below)) where available, especially during pregnancy where women are taking higher folate supplementation due to high risk for neural tube defects (e.g., previous history of neural tube defects, diabetes, obesity, epilepsy). 	<ul style="list-style-type: none"> - Educate patients on foods containing high folate levels to increase dietary intake. - Recommend patients take oral folate supplements. - Supplement/adjust folate in EN or PN. - Assess homocysteine and vitamin B12 levels.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Serum Vitamin B12 (Cobalamin)</p> <p>[L345]</p>	<ul style="list-style-type: none"> - Involved in the metabolism of every cell of the human body, especially maturation of red blood cells, DNA synthesis and regulation, fatty acid synthesis and energy production; requires gastric acid and intrinsic factor (secreted naturally by the stomach) for absorption. - Vitamin B12 deficiency can lead to pernicious <i>anemia</i>, neurological and neuromuscular disorders and failure. - <i>Gastric bypass surgery</i> patients, <i>gastrectomy</i> patients and the elderly often experience low gastric acid production which is required for release of vitamin B12 from protein foods; these populations also experience decreased intrinsic factor production leading to decreased vitamin B12 absorption. - Vitamin B12 deficiency also seen in genetic disorders of vitamin B12 metabolism, chronic kidney disease, <i>inflammatory bowel disease</i> (Crohn's disease and Ulcerative Colitis), <i>Celiac disease</i>, congestive heart failure, those consuming a vegan diet and athletes. - Vitamin B12 deficiency can be masked by high folate levels; often checked along with folate. - Monitored in diabetic patients on Metformin (an oral hypoglycaemic agent) as this medication can lower vitamin B12 levels. - Low levels may indicate depleted stores and/or absorption issues. 	<ul style="list-style-type: none"> - Educate patients on foods containing vitamin B12 to increase dietary intake. - Recommend patients take oral vitamin B12 supplements. - Supplement/adjust vitamin B12 in EN or PN. - Collaborate with physician re: need for vitamin B12 injections in patients with absorption issues. - Consider ordering Methylmelonic Acid (see below), where available.
<p>Serum Methylmelonic Acid (MMA)</p> <p>[code]</p>	<ul style="list-style-type: none"> - Where this test is available, MMA is a better indicator of active vitamin B12 than serum vitamin B12. - Monitored to help identify early or mild vitamin B12 deficiency; test may be ordered as a follow-up to a vitamin B12 test result that is in the lower end of the normal range. - May be elevated in patients with inborn errors of metabolism involving B12 metabolism. - Low levels may indicate depleted stores and/or absorption issues. - Often ordered with homecysteine and folate due to interactions. 	<ul style="list-style-type: none"> - Educate patients on foods containing vitamin B12 to increase dietary intake. - Recommend patients take oral vitamin B12 supplements. - Supplement/adjust vitamin B12 in EN or PN. - Collaborate with physician re: need for vitamin B12 injections in patients with absorption issues.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Urinary Methylmelonic Acid (MMA) [code]	<ul style="list-style-type: none"> - Non-invasive indicator of active vitamin B12 status that enables RD to determine if deficiency is related to dietary intake or malabsorption. - Provides a good index of vitamin B12 stores and distinguishes between folate and vitamin B12 deficiencies. 	<ul style="list-style-type: none"> - Educate patients on foods containing vitamin B12 to increase dietary intake. - Recommend patients take oral vitamin B12 supplements. - Supplement/adjust vitamin B12 in EN or PN. - Collaborate with physician re: need for vitamin B12 injections in patients with absorption issues.
Vitamin C (Ascorbic Acid) [L019]	<ul style="list-style-type: none"> - Vitamin C is required for the growth and repair of all body tissues; an important protein used to make skin, scar tissue, tendons, ligaments, and blood vessels; also essential for the healing of wounds and for the repair and maintenance of cartilage, bones and teeth. - Deficiencies seen in smokers and patients on dialysis who have increased vitamin C needs due to losses during dialysis treatment; toxicities are rare. 	<ul style="list-style-type: none"> - Educate patients on high vitamin C foods to increase dietary intake. - Recommend patients take oral vitamin C supplements. - Supplement/adjust vitamin C in EN or PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>25-Hydroxy Vitamin D [L606]</p>	<ul style="list-style-type: none"> - Vitamin D required for absorption of calcium to maintain bone health and for prevention/monitoring of osteoporosis, reducing risk of bone fracture and adequate immune function. - Helpful to obtain baseline measurement; monitored to treat deficiencies, adequacy of dose and to prevent toxicities in patients on mega-doses (e.g., paediatric oncology and some <i>gastric bypass surgery</i> patients). - Often monitored along with calcium and parathyroid hormone due to interactions in body mechanisms to absorb calcium. - Deficiencies seen in obese population, long-term hospital stays, the elderly, liver disease, <i>inflammatory bowel disease</i>, <i>Cystic Fibrosis</i>, <i>Celiac disease</i>, oncology patients, post-operatively in <i>gastric bypass surgery</i> patients, pregnancy, athletes, vegetarians, vegans and those with food allergies/intolerances to milk and soy (both of which are fortified with vitamin D). - Renal bone disease is a common complication of chronic kidney disease and results in both skeletal complications (e.g., abnormality of bone turnover, mineralization, linear growth) and extra-skeletal complications (e.g., vascular or soft tissue calcification); patients with kidney disease often experience low vitamin D as conversion to the active form of vitamin D occurs in the kidneys; ability to do so may be impaired in this patient population. 	<ul style="list-style-type: none"> - Educate patients on foods with high vitamin D to increase dietary intake. - Recommend patients take oral vitamin D supplements. - Supplement/adjust vitamin D in EN or PN. - For those at risk for osteoporosis, collaborate with physician re: need for bone-building medication regimen. - Monitor in combination with calcium and parathyroid hormone levels.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
1,25-Hydroxy Vitamin D [L588]	<ul style="list-style-type: none"> - This form of vitamin D reflects successful conversion (in the kidneys) from the inactive monohydroxy form of vitamin D to the active dihydroxy form. - In kidney disease, this conversion may be compromised; thus the lab level of 1,25 Vitamin D can help RDs identify issues with conversion of vitamin D to active form. - If there are bone issues (e.g., early-onset osteoporosis), 1,25 Vitamin D may be warranted to identify conversion issues. - 1,25 Vitamin D may also be recommended if liver enzymes are high, and/or if 25-hydroxyvitamin D is either very low or very high. 	<ul style="list-style-type: none"> - RDs would collaborate with physician regarding the need for <i>Calcitriol</i> medication which is often prescribed in patients with impaired active vitamin D conversion. - In patients on <i>Calcitriol</i>, RD would need to consider monitoring calcium and parathyroid hormone in addition to 1,25 Vitamin D as this medication may cause calcium levels to increase which could lead to soft tissue calcification. - RD may also educate patients to modify intake or the timing of vitamin D and calcium-containing foods as <i>Calcitriol</i> may interfere with the absorption of these nutrients.
Vitamin E [code]	<ul style="list-style-type: none"> - Vitamin E is an <i>antioxidant</i> that protects body tissues from damage caused by free radicals; important in the formation of red blood cells and it helps the body to use vitamin K; vitamin E is absorbed in small intestine. - Patients with pancreatic insufficiency, fat malabsorption, <i>Cystic Fibrosis</i>, <i>short bowel syndrome</i> and those post <i>gastric bypass surgery</i> encounter changes in fat digestion and malabsorption of fat-soluble vitamins leading to deficiencies. - Monitored in lung transplants in those with <i>Cystic Fibrosis</i> as patients often experience elevated vitamin E levels post-surgery. 	<ul style="list-style-type: none"> - Educate patients on foods containing high vitamin E to increase/decrease intake. - Recommend patients take oral vitamin E supplements. - Supplement/adjust vitamin E in EN or PN.
Vitamin K [code]	<ul style="list-style-type: none"> - Fat soluble vitamin involved in blood clotting. - Deficiencies seen in patients with fat malabsorption, <i>Cystic Fibrosis</i> and patients on long-term PN. 	<ul style="list-style-type: none"> - Due to affects of vitamin K on blood clotting, RD would collaborate with physician re: need for dietary modifications to vitamin K intake, oral supplement use, additions to EN or PN and/or need for vitamin K injection.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
MINERALS		
<p>Serum Calcium [L045]</p>	<ul style="list-style-type: none"> - Important for bone health, to help muscles and blood vessels contract and expand, to secrete hormones and enzymes and to send messages through the nervous system. - Interacts with phosphorus, vitamin D and parathyroid hormone (as calcium decreases, parathyroid hormone increases); approximately half of serum calcium is bound to albumin; accurate calcium status may need to be assessed in collaboration with albumin, phosphorus and vitamin D. - Deficiencies often seen in <i>gastric bypass surgery</i> patients, <i>inflammatory bowel disease</i>, and <i>Celiac disease</i> due to inadequate intake and/or malabsorption. - Fluctuating calcium levels seen in cardiovascular disease, respiratory conditions and oncology patients due to effects of cancer on body as well as treatment through chemotherapy and other medications; high levels often seen in lung, breast and multiple mylenomas which may require increase in fluid intake, and/or adjustments to diuretics. - Monitored to identify risk for <i>refeeding syndrome</i> in response to nutrition support. - Monitored in patients with kidney disease to identify bone mineral metabolism issues, manage phosphate binder medications and assess tolerance to vitamin D supplementation (as applicable). 	<ul style="list-style-type: none"> - Educate patients on high calcium containing foods to increase/decrease dietary intake. - Recommend patients take calcium supplements along with vitamin D (as applicable). - Supplement/adjust calcium in EN or PN. - Collaborate with physician re: need for bone-building medication if supplementation is not improving levels. - In kidney disease patients, collaborate with physician re: abnormal calcium levels to modify calcium-based phosphate binders and/or vitamin D supplements. - If calcium is high, collaborate with physician re: need for IV fluids and/or adjustments to diuretic medications. - Collaborate with MD regarding other drug-nutrient interactions impacting with calcium levels. - Assess along with phosphorus, vitamin D, parathyroid hormone and albumin levels.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Ionized Calcium [L046]</p>	<ul style="list-style-type: none"> - Measurement of free-flowing calcium in the blood that is not attached to protein (as serum calcium is attached to the protein albumin). - Checked to determine the severity of abnormal serum calcium. - High levels may indicate <i>secondary hyperparathyroidism</i>, excessive vitamin D intake, decreased urinary calcium excretion (often seen in predialysis patients), metastatic bone tumours or multiple mylenoma. - Low levels seen in patients with low thyroid function, kidney failure and vitamin D deficiency. 	<ul style="list-style-type: none"> - Educate patients on high calcium containing foods to increase/decrease dietary intake. - Recommend patients take calcium supplements along with vitamin D (as applicable). - Supplement/adjust calcium in EN or PN. - Collaborate with physician re: need for bone-building medication if supplementation is not improving levels. - <u>In kidney disease patients:</u> <ul style="list-style-type: none"> - Collaborate with physician re: abnormal calcium levels to modify calcium-based phosphate binders and/or vitamin D supplements. - If calcium is high, collaborate with physician re: need for IV fluids and/or adjustments to diuretic medications. - Collaborate with MD regarding other drug-nutrient interactions impacting with calcium levels.
<p>Chromium [code]</p>	<ul style="list-style-type: none"> - Essential for normal carbohydrate and lipid metabolism. - Excreted in urine; those on PN who have renal failure may require chromium restriction. - Deficiencies often seen in long-term PN patients; low levels can lead to impaired glucose tolerance and release of free fatty acids. 	<ul style="list-style-type: none"> - Recommend oral chromium supplements to increase intake. - Supplement/adjust chromium in EN or PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Serum Copper [L063]</p>	<ul style="list-style-type: none"> - A trace mineral, part of several enzymes and proteins that are essential for adequate use of iron by the body. - Copper is mainly absorbed in first part of small intestine (duodenum), small amounts absorbed in stomach; excreted in bile. - Routinely monitored in patients on PN with abnormal liver function. - Deficiencies seen in <i>gastric bypass surgery</i> patients, patients with protein-energy malnutrition, burn patients, and those on dialysis. - Typically monitored with albumin as copper is transported to liver bound to albumin; low albumin may give false low serum copper result. - Interacts with zinc; copper and zinc often checked together. 	<ul style="list-style-type: none"> - Educate patients on foods containing high copper to increase/decrease dietary intake. - Recommend patients take oral copper supplement. - Supplement/adjust copper in EN or PN. - Monitor albumin and zinc levels. - Collaborate with physician re: need to correct albumin levels to normalize copper status.
<p>Manganese [code]</p>	<ul style="list-style-type: none"> - A trace mineral, important in maintaining homeostasis of the metabolic synthesis of protein as well as carbohydrate and fat; excreted in bile. - High levels seen in patients on long-term PN. 	<ul style="list-style-type: none"> - Supplement/adjust manganese in PN solution. - Collaborate with physician regarding medications /diuretics to lower manganese levels and prevent toxicity.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Magnesium [L165]</p>	<ul style="list-style-type: none"> - Required as a co-factor for many enzyme systems; involved in protein synthesis and energy generation, regulates potassium and calcium, and required for vitamin D metabolism. - Abnormalities often occur in <i>gastric bypass surgery</i> patients, liver transplant patients, patients with <i>inflammatory bowel disease</i> and those with <i>high-output ostomies</i>. - Patients with long-term protein-calorie malnutrition or after long-term bowel rest (no food or water by mouth) can experience intracellular loss of magnesium during refeeding; monitoring magnesium allows for quick identification of <i>refeeding syndrome</i> and metabolic instability. - Deficiencies can cause disruptions in vitamin D metabolism and calcium levels. - Low levels of magnesium (along with potassium and phosphorus) can lead to respiratory and cardiac instability/muscle weakness. - Monitored in kidney disease patients to determine tolerance to magnesium-based phosphate binding medications. - Low magnesium may be associated with use of diuretic medications. 	<ul style="list-style-type: none"> - Educate patients regarding foods containing high magnesium to increase/decrease intake. - Recommend patients take magnesium oral mineral supplements. - Supplement/adjust magnesium in EN or PN. - Initiate oral feeding, EN and PN slowly and monitor magnesium to avoid <i>refeeding syndrome</i>. - Collaborate with physician regarding need for (or adjustments to) magnesium-based phosphate binders, diuretics and other medications that may impact magnesium absorption.
<p>Phosphorus [L194]</p>	<ul style="list-style-type: none"> - Involved in carbohydrate, protein and fat metabolism; essential for bone mineral metabolism and optimal bone health. - Influences parathyroid hormone and vitamin D levels which maintain calcium balance. - Patients with alcoholism, post <i>gastric bypass surgery</i>, long-term bowel rest and protein-calorie malnutrition can experience intracellular loss of phosphorus during refeeding; monitoring of phosphorus allows for quick identification of <i>refeeding syndrome</i> and metabolic instability. - Patients dependent on ventilator for prolonged periods of time often experience low phosphorus levels. - Low levels of phosphorus (along with potassium and magnesium) can lead to respiratory and cardiac instability/muscle weakness. - Monitored in patients with kidney disease to manage phosphate-binding medications and modifications to vitamin D supplementation. 	<ul style="list-style-type: none"> - Educate patients regarding foods containing high phosphorus to increase/decrease dietary intake. - Recommend patients take oral phosphorus mineral supplements. - Supplement/adjust phosphorus in EN and PN. - Initiate oral feeding, EN and PN slowly and monitor phosphorus to avoid <i>refeeding syndrome</i>. - Collaborate with physician regarding need for (or adjustments to) phosphate binding medications and vitamin D supplementation.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Serum Zinc [L266]</p>	<ul style="list-style-type: none"> - Involved in numerous aspects of cellular metabolism; plays a role in immune function, protein synthesis, wound healing, DNA synthesis, and cell division; supports normal growth and development during pregnancy, childhood, and adolescence and is required for proper sense of taste and smell. - Low levels can lead to taste changes (often accompanied by metallic taste in mouth) and decreased appetite which may explain poor oral intake. - Deficiencies seen in <i>gastric bypass surgery</i> patients, <i>inflammatory bowel disease</i> (Crohn's disease and Ulcerative Colitis), oncology and kidney disease patients, pancreatic insufficiency, alcoholic pancreatitis, HIV, <i>short bowel syndrome</i>, long-term PN, burn patients, alcoholism, anorexia, vegetarians and vegans, <i>failure to thrive</i>, genetic or metabolic disorders, muscle depletion, the elderly as well as severe diarrhea and high output ostomies (e.g., <i>ileostomy</i>). - Elevated levels seen in cardiovascular disease and over-supplementation. - Interacts with copper; zinc and copper often checked together. - Typically monitored with albumin as zinc is transported in the body bound to albumin; low albumin may give false low zinc result. 	<ul style="list-style-type: none"> - Educate patients on foods containing high zinc to increase/decrease dietary intake. - Recommend patients take oral zinc supplements. - Supplement/adjust zinc in EN or PN. - Monitor copper and albumin levels. - Collaborate with physician re: need to correct albumin levels to normalize zinc status.
<p>RBC Zinc [code]</p>	<ul style="list-style-type: none"> - Second level of zinc status assessment to determine if zinc levels are abnormal in patients who present with zinc deficiency symptoms. - Low RBC Zinc would confirm zinc deficiency. 	<ul style="list-style-type: none"> - Educate patients on foods containing high zinc to increase/decrease dietary intake. - Recommend patients take oral zinc supplements. - Supplement/adjust zinc in EN or PN. - Monitor copper and albumin levels. - Collaborate with physician re: need to correct albumin levels to normalize zinc status.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Erythrocyte (ERC) Zinc [code]	<ul style="list-style-type: none"> - To assess zinc status; a better marker than serum zinc, but test is not readily available. 	<ul style="list-style-type: none"> - Educate patients on foods containing high zinc to increase/decrease dietary intake. - Recommend patients take oral zinc supplements. - Supplement/adjust zinc in EN or PN. - Monitor copper and albumin levels. - Collaborate with physician re: need to correct albumin levels to normalize zinc status.
Selenium [code]	<ul style="list-style-type: none"> - Trace mineral involved in protein synthesis and plays a role as a co-factor for selenium-dependent enzymes; involved in wound healing; absorbed in small intestine. - Deficiencies seen in <i>gastric bypass surgery</i> patients, bowel resections where a large portion of small intestine is <i>bypassed</i>, <i>high-output ostomies</i>, patients on long-term PN, persistent diarrhea and <i>inflammatory bowel disease</i>. - Selenium binds to albumin; low albumin may produce a falsely low serum selenium result; selenium often monitored along with albumin. 	<ul style="list-style-type: none"> - Educate patients on foods containing high selenium to increase/decrease dietary intake. - Recommend patients take oral selenium supplements. - Supplement/adjust selenium in EN or PN. - Monitor albumin levels. - Collaborate with physician re: need to correct albumin levels to normalize selenium status.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Iron Panel:</p> <p>Serum Iron [L139] Ferritin [L329] Total Iron Binding Capacity (TIBC) [L329] Transferrin Saturation [code] Serum Transferrin Receptors [code] Transferrin Receptor Index [code]</p>	<ul style="list-style-type: none"> - Iron tests are typically ordered in combination to identify or rule-out issues with dietary iron intake, circulating iron (serum iron), iron storage (ferritin) and iron binding capacity in the body (TIBC and transferrin saturation); monitored to prevent/treat iron deficiencies. - Iron absorbed mainly through small intestine; deficiencies seen in <i>gastric bypass surgery</i> patients, <i>inflammatory bowel disease</i> (Crohn's disease, Ulcerative Colitis), <i>Cystic Fibrosis</i> and <i>Celiac disease</i>. - Deficiencies also common in patients with kidney disease, liver disease, congestive heart failure, menstruating women, eating disorders, infants/children consuming excess cow's milk, vegetarians, athletes, and the elderly who consume little red meat intake or foods containing iron. - Iron panel useful in pregnancy to identify early stages of iron deficiency through ferritin levels (stored iron) when other values (e.g., hemoglobin) may be normal; iron monitored throughout pregnancy to ensure adequate level required for fetal development. - Elevated serum iron results may identify iron overload. - Serum transferrin receptors increase with iron deficiency and are unaffected by chronic disease states; used as a sensitive and specific test for assessing iron status. - Iron may be checked along with vitamin B 12 and folate as these vitamins interact with this mineral. 	<ul style="list-style-type: none"> - Educate patients regarding foods containing high iron to increase/decrease intake. - Recommend patients take iron supplements. - Supplement/adjust iron in EN or PN. - Collaborate with physician re: need for prescription medications to manage severe iron deficiency, medications to manage iron overload, or other medications impacting iron status. - Monitor vitamin B12 and folate as required.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
ELECTROLYTES		
Bicarbonate [L061]	<ul style="list-style-type: none"> - Used to monitor acid-base balance in patients; often monitored with chloride and potassium. - High levels may indicate <i>alkalosis</i> and/or vomiting or purging in eating disorder patients; low levels may indicate high protein intake, <i>diabetic ketoacidosis</i>, and/or diarrhea. 	<ul style="list-style-type: none"> - Collaborate with physician regarding best method to correct acid-base imbalance; consider need for sodium bicarbonate supplementation, need for added buffer (acetate) to PN solution and/or need for adjustment of chloride and potassium.
Chloride [L053]	<ul style="list-style-type: none"> - Required for energy metabolism and also helps maintain the body's acid-base balance; amount in blood is carefully controlled by kidneys. - Monitored to determine acid-base balance in patients, especially those on PN; often monitored along with bicarbonate and potassium. - Component of electrolyte testing for assessment of hydration status and kidney function insufficiencies. - High levels may indicate dehydration; low levels may indicate over-hydration, metabolic <i>alkalosis</i>, or losses from diarrhea and vomiting, or abuse of laxatives/diuretics in eating disorder patients. 	<ul style="list-style-type: none"> - Educate patients on increasing/decreasing oral fluid intake and/or recommend electrolyte replacement beverage containing chloride. - Modify water flushes in patients on EN. - Adjust chloride in PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Potassium [L204]</p>	<ul style="list-style-type: none"> - Essential for maintaining normal osmotic pressure in cells, and maintaining normal cardiac and muscular function; acts as a co-factor for numerous enzymes, required for secretion of insulin, required for carbohydrate metabolism and protein synthesis; assists in maintaining acid-base balance. - Potassium and other electrolyte abnormalities may occur in athletes, eating disorders (due to purging or diuretic/laxative abuse) <i>gastric bypass surgery</i> patients, patients on diuretic medications and those who experience persistent diarrhea or vomiting. - Patients with long-term protein-calorie malnutrition can experience intracellular loss of potassium during refeeding; monitoring of potassium allows for quick identification of <i>refeeding syndrome</i> and metabolic instability in those feed orally or through EN or PN. - Monitored with other electrolytes in patients with <i>high-output ileostomies</i>. - Abnormalities seen in kidney disease due to decreased potassium excretion in urine, intake of high potassium foods and medications that inhibit potassium excretion; low levels may be due to increased losses during dialysis. - Low levels of potassium (along with magnesium and phosphorus) can lead to respiratory and cardiac instability/arrhythmias and muscle weakness. 	<ul style="list-style-type: none"> - Educate patients regarding foods containing high potassium to increase/decrease intake. - Recommend patients take oral potassium supplements. - Supplement/adjust potassium in EN or PN. - Initiate EN and PN feeds slowly and monitor potassium to avoid <i>refeeding syndrome</i>. - Collaborate with physician re: need for (or adjustment to) diuretics, potassium chelators and/or modification of dialysate bath in kidney disease patients undergoing dialysis. - Collaborate with physician re: need for intravenous potassium in patients with <i>high-output ileostomies</i>.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Sodium [L226]</p>	<ul style="list-style-type: none"> - Essential for regulating fluid balance in the body; often monitored with other markers of fluid/hydration status. - Elevated levels can indicate dehydration or excessive sodium intake; low levels can indicate fluid overload or sodium loss. - Disturbances seen post-operatively in <i>gastric bypass surgery</i> patients due to persistent diarrhea, vomiting and/or poor fluid intake. - Sodium depletion seen in patients with high stool and urine output as well as <i>high-output ostomies</i>, patients with edema (fluid retention), severe burns, starvation, water loading, diuretic and laxative abuse in eating disorder patients; sodium depletion (and other electrolyte imbalances) also seen in athletes due to sweat losses. - Most EN formulas contain low sodium and patients who are dependent solely on EN may develop low sodium levels. - Sodium monitored in kidney disease patients to determine target weights pre/post dialysis. - Monitored in conditions such as congestive heart failure and SIADH where fluid balance is a concern. - Often monitored with other electrolytes and minerals such as calcium and magnesium. 	<ul style="list-style-type: none"> - Educate patients on increasing/decreasing oral fluids and/or sodium intake. - Adjust water flushes and/or sodium in EN. - Adjust sodium in PN. - Collaborate with physician re: fluids administered intravenously, diuretics and other medications affecting sodium/fluid balance.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
HEMATOLOGY		
<p>Complete Blood Count (CBC) [L393]</p> <p>Includes: While Blood Cell (WBC) Differential [L372] WBC Count [L399] Platelet Count [L396] Red Blood Cell Count (RBC) [L397] Red Blood Cell Width (RDW) [code] Hematocrit (HCT) [L417] Hemoglobin (Hgb) [L418] Mean Cell Hemoglobin [code] Mean Corpuscular Volume (MCV) [code] Mean Corpuscular Hemoglobin (MCH) [code] Mean Corpuscular Hemoglobin Concentration (MCHC) [code]</p>	<ul style="list-style-type: none"> - CBC typically monitored as an initial screening indicator of iron status, hydration and presence of infection. WBC Differential and WBC Count: <ul style="list-style-type: none"> - Indicates ability of patients to fight infection and possible presence of infection; high levels seen in acute infection, malignancy; low levels seen during chemotherapy and radiation. RBC: <ul style="list-style-type: none"> - Rarely high; low levels may indicate iron deficiency, blood loss or low vitamin B12 and folate levels. HCT: <ul style="list-style-type: none"> - Indicates the percentage of the volume of blood that is made up of RBCs; this measurement depends on the number and size of RBCs. - High levels may indicate dehydration, low levels may indicate iron deficiency, blood loss or over-hydration. Hgb: <ul style="list-style-type: none"> - The protein molecule in RBCs that carries oxygen from the lungs to the body's tissues and returns carbon dioxide from the tissues to the lungs. - High levels may indicate dehydration, congestive heart failure, use of <i>Erythropoietin</i> (to increase red blood cell production); low levels may indicate iron deficiency (especially to monitor changes to Hgb during pregnancy), folic acid and/or vitamin B 12 deficiency, chronic infection; low levels seen in athletes which may impact performance. MCV: <ul style="list-style-type: none"> - Indicator of the size of RBC; low levels may indicate smaller RBCs from iron deficiency; high levels may indicate larger RBCs caused by folate and vitamin B12 deficiencies; folate and vitamin B12 should be tested to determine if cause of <i>anemia</i> is related in-part to these vitamin deficiencies; low levels seen in athletes which may impact performance. MCH & MCHC: <ul style="list-style-type: none"> - Calculation of size and average amount of Hgb inside RBC; indicates type of <i>anemia</i>. 	<ul style="list-style-type: none"> - If WBC low, RD may discuss strategies for food safety and prevention of food-borne illnesses (e.g., cooking times, avoiding cross-contamination, etc.). - If RBC, HCT or Hgb low, may require further iron status lab tests: serum iron, ferritin, TIBC, transferrin saturation as well as assessment of vitamin B12 and folate status to confirm or rule-out deficiencies. - RD may initially educate patients on increasing iron-containing foods in diet. - Recommend oral iron supplementation and or supplement iron in EN or PN. - Collaborate with physician regarding patients on <i>Erythropoietin</i> (EPO) medication to determine adequate balance of iron supplements and EPO dosage.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Prothrombin Time/International Normalized Ratio (PT/INR) [L445]</p>	<ul style="list-style-type: none"> - PT/INR measures the ability of blood to clot properly; can be used to help identify bleeding risk. - In some facilities, RDs insert nasogastric tubes (through a medical directive/delegation) to initiate EN; monitoring PT/INR prior to tube feed insertion helps to identify issues with clotting abnormalities that RD would address with physician. - Clotting abnormalities seen in patients with liver disease, vitamin K deficiency or a coagulation factor deficiency. - <i>Gastric bypass surgery</i> can impede vitamin K and other fat-soluble vitamin absorption. 	<ul style="list-style-type: none"> - Due to potential risk involved with abnormal blood clotting, RD would always collaborate with MD re: coagulation therapy and interactions with dietary vitamin K intake or vitamin K additions to EN or PN. - If warranted, RD would educate clients on foods containing high/low vitamin K levels and timing of high vitamin K food intake with blood thinning medications.
<p>C-Reactive Protein (CRP) [L665]</p>	<ul style="list-style-type: none"> - CRP is a protein found in blood that is produced by the liver in response to fat cells; levels rise in response to inflammation. - Assists in interpretation of prealbumin and albumin to determine if inflammation is the cause of these abnormal protein levels. - Changes in CRP during the course of illness are associated with changes in plasma concentrations of trace elements (e.g., high CRP leads to decreased iron and zinc and increased copper levels). If anticipated changes do not occur when CRP levels normalize, this may reflect abnormalities in status of trace elements. - Spinal cord injury patients are at high risk for inflammatory disorders leading to elevated CRP levels. 	<ul style="list-style-type: none"> - CRP allows RD to make informed decision of need for trace minerals through modifications to diet, supplement intake, and additions/exclusions from EN and PN. - Identifies need for RDs to educate patients to increase omega-3 fatty acids in diet and decrease omega-6 fatty acid intake to help with inflammatory response. - RD may adjust EN formula or adjust lipids in PN to include omega-3 fatty acids. - CRP is monitored to determine when inflammatory response has subsided to discontinue omega-3 EN formula or discontinue omega-3 addition to PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
KIDNEY DISEASE		
<p>Albumin [L005, qualitative] [L004, quantitative]</p>	<ul style="list-style-type: none"> - Albumin is the main protein of plasma; it binds water, cations (such as calcium, sodium, and potassium), fatty acids, hormones, bilirubin and many medications; its main function is to regulate the osmotic pressure of blood. - About half of circulating blood calcium is bound to albumin; albumin is used to accurately assess calcium status. - Low albumin seen with low calcium levels; correcting calcium depletion helps correct low albumin levels. - May be an indicator of visceral protein status; low levels often seen in patients with multiple allergies, malabsorption, cancer, liver disease, end-stage kidney failure, over-hydration or edema (fluid retention), inflammation and in those who are malnourished. - High levels seen in dehydration. 	<ul style="list-style-type: none"> - If albumin levels are abnormal, RD would collaborate with MD to rule-out dehydration/over-hydration. - Educate client to increase/decrease fluid intake. - Increase/decrease water flushes in EN. - When calcium levels are low: educate client to increase dietary calcium intake, recommend patients take oral calcium supplements or add calcium to EN or PN.
<p>Prealbumin [code]</p>	<ul style="list-style-type: none"> - Prealbumin has a half-life of 2-3 days and is a good marker of protein-energy malnutrition and response to nutritional therapies. - Low levels seen in liver disease, infection, and malnutrition. - Elevated levels seen in renal failure. 	<ul style="list-style-type: none"> - Educate patients on increasing oral protein and calorie intake. - Adjust formula (type, rate, timing) if being fed through EN. - Adjust protein in PN solution.
<p>Total Protein [L208]</p>	<ul style="list-style-type: none"> - Marker of protein status in the body. - High levels can indicate dehydration; low levels can indicate low protein intake resulting in negative nitrogen balance, leading to muscle wasting. - Low levels seen in malnourished patients, anorexia and bulimia eating disorder patients and dehydration. 	<ul style="list-style-type: none"> - Educate patients on increasing oral protein and fluid dietary intake. - Adjust EN formula (e.g., higher protein product, and water flushes). - Adjust protein in PN solution.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Glomerular Filtration Rate (eGFR) [code]	<ul style="list-style-type: none"> - Describes the flow rate of filtered fluid through the kidneys. - eGFR is calculated from the results of a creatinine test. - Used to screen for and detect early kidney damage (e.g., in diabetics) and to monitor kidney function in patients with chronic kidney disease. 	<ul style="list-style-type: none"> - Modify diet education for increasing/decreasing protein, vitamin, mineral, electrolyte and/or fluid intake. - Depending on functional ability of kidneys, RD may change EN regimen/formula or adjust components of PN solution.
Dialysate Analysis for Glucose, Urea, Creatinine [code]	<ul style="list-style-type: none"> - To determine protein catabolic rate, dialysate clearance, and glucose absorption. 	<ul style="list-style-type: none"> - RD would modify nutrition care plan (oral, EN, or PN) to increase/decrease protein, carbohydrate and total calorie intake.
Blood Urea Nitrogen (BUN) [L251]	<ul style="list-style-type: none"> - BUN is formed when protein breaks down in the body; a measure of kidney function. - High levels may indicate dehydration from reduced fluid intake and/or vomiting and diarrhea as well as reduced kidney function or inadequate dialysis; high levels can lead to decreased appetite as urea builds up in blood. - Low levels may indicate a low-protein diet or malnutrition, fluid overload, SIADH or too frequent dialysis. - Abnormalities often seen in chronic kidney disease and patients undergoing chemotherapy. 	<ul style="list-style-type: none"> - Educate patients on increasing/decreasing fluid intake. - Educate patients on increasing/decreasing protein intake. - Adjust type of EN formula (e.g., higher/lower protein product and increase/decrease water flushes). - Increase/decrease protein in PN. - In oncology patients, RD would collaborate with physician and pharmacist to determine if chemotherapy may be causing kidney damage or whether dehydration was a concern.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Serum Creatinine [L067]</p>	<ul style="list-style-type: none"> - Creatinine is a breakdown product of creatine, which is an important part of muscle; marker of lean body mass/skeletal protein levels. - Creatinine is a marker of kidney function; creatinine is removed from the body by kidneys and excreted in the urine. - Used to monitor patients with diabetes and chronic kidney disease; monitored along with BUN and urinary creatinine clearance. - High levels may indicate reduced kidney function (as creatinine not excreted in urine), insufficient dialysis, and/or dehydration from lack of fluid intake and/or vomiting/diarrhea. - Low levels seen in liver disease and pregnancy signalling lean body mass loss which may warrant an increase in protein and calorie intake. 	<ul style="list-style-type: none"> - Educate patients to increase/decrease fluid and protein intake. - Reduced renal function may also require decreased potassium, phosphorus, and magnesium intake. - Adjust fluid protein, electrolyte, vitamins and minerals (required) in EN or PN. - Collaborate with physician re: dialysate to improve clearance during dialysis. - In oncology patients, collaborate with physician and pharmacist to determine if chemotherapy or other medications may be causing kidney damage requiring dietary modifications or whether dehydration is a concern.
<p>Urinary Creatinine Clearance [L068]</p>	<ul style="list-style-type: none"> - Creatinine is a breakdown product of creatine, which is an important part of muscle; marker of lean body mass/skeletal protein levels; creatinine is removed from the body by kidneys and excreted in urine; marker of kidney function. - Often monitoring along with BUN and serum creatinine. 	<ul style="list-style-type: none"> - Educate patients to increase/decrease fluid/protein intake. - Reduced renal function may also require decreased potassium, phosphorus, and magnesium intake. - Adjust fluid protein, electrolyte, vitamins and minerals (as required) in EN or PN. - Collaborate with physician re: dialysate to improve clearance during dialysis. - In oncology patients, collaborate with physician and pharmacist to determine if chemotherapy or other medications may be causing kidney damage requiring dietary modifications or whether dehydration is a concern.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Serum Osmolality [L183]</p>	<ul style="list-style-type: none"> - Measures the number of solutes present in the blood to help evaluate the body's water balance, its ability to produce and concentrate urine, and to help investigate fluid status, low sodium levels and presence of SIADH. - Elevated osmolality seen in patients with high sodium levels and dehydration. - Often monitored with sodium. 	<ul style="list-style-type: none"> - Educate patients on increasing/decreasing fluid and sodium intake. - Adjust EN and PN regimens to increase/decrease fluid intake. - Collaborate with physician regarding the need for (or modifications to) diuretics.
<p>Albumin/Creatinine Ratio, Urine [code]</p>	<ul style="list-style-type: none"> - Estimates 24-hour urine albumin excretion/spilling of albumin in urine and is unaffected by variation in urine concentration. - Preferred measure for screening, assessing and monitoring early kidney damage. - Often measured along with eGFR to determine stage of kidney function that may impact nutrition care plan. - Indicates compliance in protein, carbohydrate and fluid intake as well as balance of carbohydrate-protein intake. 	<ul style="list-style-type: none"> - Helps RD to direct patient education to identify a need for modifying protein, fluid and/or carbohydrate oral intake. - Adjust protein, fluid and/or carbohydrate intake in EN or PN.
<p>Uric Acid (Urate) [L252]</p>	<ul style="list-style-type: none"> - Final breakdown product of purine (organic compounds found in food) metabolism in the body and is excreted in urine. - Monitored in patients with glycogen storage disorders who require purine and carbohydrate modified diets. - Also monitored in patients with gout to determine need for dietary modifications to prevent gout flare-ups or uric acid stones as well as compliance with gout medication. - High levels may indicate disordered purine metabolism associated with excessive production and impaired excretion of uric acid; low levels may indicate possible malnutrition or excessive gout medication (e.g., Allopurinol). 	<ul style="list-style-type: none"> - Educate patients on decreasing consumption of high-purine foods and alcohol as well as increasing fluid intake to increase urine volume output. - Collaborate with physician re: modifications to gout medications and/or need for further investigation of possible disordered purine metabolism.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Urinary Uric Acid (Urinary Urate) [code]	<ul style="list-style-type: none"> - Measurement of purine compounds excreted in urine. - Monitored in patients with gout to determine compliance with dietary restriction and gout medications. 	<ul style="list-style-type: none"> - Educate patients on decreasing consumption of high-purine foods and alcohol as well as increasing fluid intake to increase urine volume output. - Collaborate with physician re: modifications to gout medications.
24-Hour Urinalysis for Urea Nitrogen (UUN) [code]	<ul style="list-style-type: none"> - A measure of protein breakdown in the body; quantifies amount of protein breakdown to help determine patients' protein needs. - Measured in patients with chronic kidney disease. - Inadequate protein delivery or accumulated protein deficit has negative effects on critically ill patients (e.g., immune dysfunction, risk for infection, poor wound healing, weight loss, decreased functional capacity, and prolonged hospital stay). 	<ul style="list-style-type: none"> - Educate patients to increase/decrease oral protein intake. - Adjust protein in EN and PN.
24-Hour Urinalysis for Total Volume [code]	<ul style="list-style-type: none"> - Assesses the kidney's ability to excrete fluids. - Monitored in patients with kidney disease and to determine fluid needs and assess compliance with fluid intake recommendations. 	<ul style="list-style-type: none"> - Educate patients to increase/decrease oral protein intake. - Adjust protein in EN and PN - Collaborate with physician re: need for (or adjustment to) diuretics and other medications influencing fluid/hydration status.
24-Hour Urinalysis for Sodium [code]	<ul style="list-style-type: none"> - Useful in the assessment of low-salt dietary compliance in the management of <i>ascites</i>, which can lead to decreased appetite. - <i>Ascites</i> is typically caused by liver disease and is common in patients waiting for a liver transplant who often require frequent <i>paracentesis</i>. - Also used to assess excessive sodium intake in patients at risk for kidney stones; excessive sodium intake can increase calcium excretion; monitored along with urinary calcium. 	<ul style="list-style-type: none"> - Educate patients to decrease oral sodium intake. - Adjust sodium intake in EN or PN. - Collaborate with physician re: diuretics or other medications impacting hydration status. - In patients with risk of kidney stones, educate to increase fluid intake; if calcium low, educate to increase oral intake or recommend supplements.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Urinalysis for Protein [L253]	<ul style="list-style-type: none"> - Measures spilling of protein in urine due to inadequate kidney function. - Indicator of compliance with protein restriction recommendations. 	<ul style="list-style-type: none"> - Educate patients to decrease protein intake to reduce spilling of protein in urine. - Adjust protein intake in EN or PN.
Urinalysis for Citric Acid [code]	<ul style="list-style-type: none"> - Citric acid in the urine helps reduce the formation of kidney stones; high animal protein intake reduces the concentration of citric acid, so kidney stones form more easily. - Measured to determine initial urinary citric acid level to assess risk of kidney stones; ongoing monitoring to determine compliance with dietary recommendations. 	<ul style="list-style-type: none"> - Educate patients to reduce dietary intake of animal protein and other foods that may reduce citric acid in urine. - Educate patients to increase fluid and dietary citric acid intake (e.g., lemon juice). - Collaborate with physician re: drug-nutrient interactions that may be increasing risk of kidney stones.
Urinalysis for Oxalates [L184]	<ul style="list-style-type: none"> - Oxalates are compounds that occur naturally in some foods. - Most kidney stones are made of calcium oxalate; calcium combines with oxalate in the intestines. - High dietary intake of oxalates may reduce the ability of calcium to be absorbed; urinary oxalates often monitored along with urinary calcium. - Measured to determine whether there is a need for dietary oxalates reduction. - Monitored to determine whether the client has been successful in reducing oxalate intake. 	<ul style="list-style-type: none"> - Educate patients to reduce dietary intake of oxalate-containing foods. - Educate patients to increase intake of fluids and calcium-containing foods and recommend dietary calcium supplement as applicable. - Collaborate with physician re: drug-nutrient interactions that may be increasing risk of kidney stones.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Urinalysis for Calcium [code]</p>	<ul style="list-style-type: none"> - Most kidney stones are made of calcium oxalate; calcium combines with oxalate in the intestines. - High dietary intake of oxalates may reduce the ability of calcium to be absorbed; urinary calcium often monitored along with oxalates. 	<ul style="list-style-type: none"> - Educate patients to increase intake of fluids and calcium-containing foods and recommend dietary calcium supplement as applicable. - Collaborate with physician re: drug-nutrient interactions that may be increasing risk of kidney stones.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
LIVER DISEASE		
<p>Liver Function Panel</p> <p>Includes: Aspartate Aminotransferase (AST) [L222] Alanine Aminotransferase (ALT) [L223] Alkaline Phosphatase (ALP) [L191] Bilirubin [L030]</p> <p>Tests can be ordered individually or as part of a liver function panel.</p>	<ul style="list-style-type: none"> - Monitored when patients have liver injury or are at risk for developing liver disease (e.g., liver function abnormalities seen in long-term PN, chemotherapy, NAFLD, bone marrow transplants, genetic metabolic diseases, trauma, and burns). - Also used to monitor liver function in patients who are on statin medications to lower cholesterol levels; statins can impact liver function and may require modifications to calorie/fat/protein intake. - AST, ALT and bilirubin are monitored in long-term PN patients to determine tolerance to nutrient intake and to assess levels to indicate cholestasis (when bile cannot flow from the liver to the duodenum). - ALP is a zinc-dependent enzyme; may be an indirect indicator of zinc status when AST and ALT are normal; a low ALP along with a low zinc level may confirm zinc deficiency to help correct taste and appetite abnormalities. - ALT & AST indicate the liver's tolerance for fat-soluble vitamins. 	<ul style="list-style-type: none"> - Educate patients on low-liver burden diet including modifications to calorie, fat, protein and carbohydrate intake. - Adjust EN or PN to lower protein, fat, sodium and fluids. - Collaborate with physician re: changing feeding regimen from PN to EN in patients who are not tolerating PN. - Adjust PN (e.g., remove manganese, copper). - Confirmation of zinc deficiency may require education to increase zinc-containing foods, oral supplements, or additions to EN or PN solution. - Collaborate with physician re: drug-nutrient interactions impacting liver function.
<p>Intralipid</p> <p>[code]</p>	<ul style="list-style-type: none"> - Fat solution used in PN administration. - Monitored in neonates with cardiac stressors, patients with new initiation of PN or those patients on long-term PN to determine how well the patient is metabolizing or handling the lipid infusion. - Decreased lipid metabolism seen in preterm infants and with malnourished, septic, and/or acutely ill infants. 	<ul style="list-style-type: none"> - Adjust amount and/or rate of lipid administration in PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Ammonia [L015]</p>	<ul style="list-style-type: none"> - A metabolic by-product of amino acid breakdown. - Monitored to determine tolerance to protein intake in patients with liver failure. - Patients with liver disease and certain inborn errors of metabolism often have altered ammonia metabolism; elevated levels can have negative effects on the brain. 	<ul style="list-style-type: none"> - Educate patients to decrease quantity and/or type of protein intake. - Consider need for branched-chain amino acid therapy in EN and/or lower protein content of EN or PN.
<p>Lactate (Lactic Acid) [L145]</p>	<ul style="list-style-type: none"> - Marker of lactate production formed when the body breaks down carbohydrates to use for energy during times of low oxygen levels. - Lactate builds up when patients are not being provided adequate nutrition (e.g., insufficient glucose/sugar) and therefore glucose/sugar is not able to be metabolized or broken down to provide carbon dioxide and water required for energy production in the body. - Lactate can also be a marker of blood flow/oxygen supplied to gastrointestinal tract; assists in assessing adequate gastrointestinal tract function to safely start EN or to start/continue PN. - Often elevated in respiratory disorders, liver disease, glycogen storage diseases treated with carbohydrate modified diets and patients with organic acidemias which are treated with modified protein diets. - RD would use lactate (in addition to other biochemistry) to adjust the amount of protein, carbohydrate or energy/calories being provided in the diet to assist with the reduction of lactate levels. 	<ul style="list-style-type: none"> - Educate patient to adjust amount dietary calorie/protein/carbohydrate intake. - Adjust calorie/protein/carbohydrate content of EN or TPN. - Collaborate with physician re: patient's ability to tolerate EN or PN.
<p>24-Hour Urinary Lactate to Creatinine Ratio [code]</p>	<ul style="list-style-type: none"> - Used as a marker of lactate production in disease states characterized by increased lactate levels (e.g., glycogen storage diseases who receive specific quantities of carbohydrate at multiple times during a 24-hour period). - Identifies specific changes to lactate levels across the 24-hour period to modify the amount of carbohydrate provided orally or through EN or PN to suppress lactate production. - Lactate alone would not allow RD to pinpoint variation of lactate levels throughout the day limiting the ability to make time-specific adjustments to carbohydrate intake. 	<ul style="list-style-type: none"> - Educate patient to adjust amount or timing of dietary carbohydrate intake. - Adjust amount or timing of carbohydrate content of EN or TPN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
PANCREATIC DISEASE		
Amylase [L018]	<ul style="list-style-type: none"> - An enzyme involved in carbohydrate digestion. It is produced mainly in the pancreas and the glands that make saliva. When the pancreas is diseased or inflamed, amylase is released into the blood and is thereby a marker of pancreatic function. - Elevated amylase levels may indicate the need for tube feed placement past stomach into small intestine and/or elemental EN formula. - When initiating EN, increased amylase may indicate undesirable pancreatic stimulation or intolerance to EN. - Elevated levels of amylase seen in eating disorder patients experiencing vomiting or excessive gum chewing. - Often ordered in combination with lipase. 	<ul style="list-style-type: none"> - Educate patients to limit carbohydrate intake if levels indicate reduced pancreatic function. - Use specialized elemental EN formulations. - Reduce carbohydrate in PN solution - Collaborate with physician re: optimal placement of tube for EN. - Monitor lipase.
Lipase [L150]	<ul style="list-style-type: none"> - A protein released by the pancreas into the small intestines; triggers the breakdown of fat into fatty acids and is a marker of pancreatic function. - Elevated lipase levels may indicate, pancreatitis, excess fat intake in patients on a <i>ketogenic diet</i>, and/or the need for tube feed placement past the stomach into the small intestine and/or an elemental EN formula. - When initiating EN, increased lipase may indicate undesirable pancreatic stimulation or intolerance to EN. - Often ordered in combination with amylase. 	<ul style="list-style-type: none"> - Educate patients to limit fat intake if levels indicate reduced pancreatic function. - Use specialized elemental EN formulations and those lower in fat. - Reduce lipids in PN solution. - Collaborate with physician re: optimal placement of tube for EN. - Educate eating disorder patients on strategies to increase dietary food intake and decrease gum chewing; adapt nutrition care plan to include regular meals/snacks to decrease susceptibility to binging/purging. - Monitor amylase.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
DIABETES		
Random Blood Glucose [L111]	<ul style="list-style-type: none"> - Provides a measure of circulating blood glucose levels at a random point in time to determine the body's ability for maintaining blood sugar control. - Used for monitoring of diabetic patients who are unable to have a fasting blood glucose test or those who are not self-monitoring with glucose meter and/or those patients who haven't been seen regularly by an RD and "drop in." - Monitored post-operatively in <i>gastric bypass surgery</i> patients to determine improvements in blood glucose levels (many diabetic patients see improvements in blood glucose levels following <i>gastric bypass surgery</i>). - Monitored to avoid high blood glucose levels when refeeding patients after prolonged bowel rest. - Physiological stress of cancer can alter blood glucose levels (even in those who are not diabetic); monitored in oncology patients to ensure normal blood glucose levels. - Can be an initial indicator that client is at risk of gestational diabetes or impaired glucose tolerance in pregnancy. - May be used as a yearly calibration tool to compare random blood glucose with patient's glucose meter results. 	<ul style="list-style-type: none"> - Educate patients on dietary changes to carbohydrate intake to achieve glucose control for both high and low blood sugar levels. - Adjust EN formula, rate, and/or timing. - Adjust carbohydrate intake in PN. - Collaborate with physician re: adjustments to insulin/oral hypoglycaemic agents. - Adjust insulin/oral hypoglycaemic agents where delegation exists and communicate changes to physician and rest of health care team. - Collaborate with physician re: need for Oral Glucose Tolerance Test to confirm/rule-out diabetes.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Fasting Blood Glucose [code]	<ul style="list-style-type: none"> - Provides a measure of circulating blood glucose levels in a fasting state to determine the body's ability for maintaining blood sugar control and identify impaired fasting blood glucose. - Helpful in patients who are not self-monitoring blood glucose levels with glucose meter to identify fasting glucose patterns that may require modifications to nutrition and pharmacological care. - Used when Hgb A1c does not correlate to their glucose self-monitoring through glucose meter checks. - Patients with <i>inflammatory bowel disease</i>, pancreatitis, severe infection, chronic liver disease, inborn errors of metabolism and those on prednisone often experience abnormal fasting blood glucose levels or steroid-induced diabetes. - May be used as a yearly calibration tool to compare fasting blood glucose with patient's glucose meter results. - Used to monitor blood glucose control in non-diabetic eating disorder patients to assess glycogen stores and determine compliance to dietary intake, as low levels may indicate minimal oral intake. 	<ul style="list-style-type: none"> - Educate patients on dietary changes to carbohydrate intake to achieve glucose control for both high and low blood sugar levels. - Adjust EN formula, rate, and/or timing. - Adjust carbohydrate in PN. - Collaborate with physician re: recommendations for adjustments to insulin/oral hypoglycaemic agents as required. - Where a delegation exists for RDs to adjust insulin/oral hypoglycaemic agents, adjust levels accordingly and communicate changes to physician and rest of health care team. - Collaborate with physician re: need for Oral Glucose Tolerance Test to confirm/rule-out diabetes. - Recommend new glucose meter where fasting blood glucose results show discrepancies with meter. - Educate eating disorder patients on strategies to increase dietary food intake.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Oral Glucose Tolerance Test</p> <p>[Standard test: L104 blood and L253,urine]</p> <p>[Gestational test, L103]</p>	<ul style="list-style-type: none"> - Determines the body's ability to handle a glucose load. - Identifies impaired glucose intolerance (IGT) and impaired fasting glucose (IFG), both of which are risk factors for developing diabetes. - Used by physicians to diagnose diabetes. - IGT/IFG can be seen in many conditions including overweight patients, those with family history of diabetes, polycystic ovarian syndrome, those with history of gestational diabetes, and patients with <i>Cystic Fibrosis</i>. <p>In Pregnancy:</p> <ul style="list-style-type: none"> - All pregnant women between 24-28 weeks are screened for gestational diabetes (GDM) through 50 g glucose load. - If results show IGT, further testing with a larger glucose load (75 g) may be warranted to confirm IGT or GDM. - Timing is critical: If patients are screened too early, GDM may be missed as hormones released during pregnancy that cause insulin resistance are lower prior to 24 weeks gestation; if screened too late, may lead to pregnancy complications to both mother and fetus. - To ensure minimal risk to baby, RD authority to order this test would be efficient patient-centred care; RD would refer patient to physician to confirm formal GDM diagnosis and have physician prescribe pharmacological treatment. - In obese gestational clients, test is repeated in 3rd trimester if normal at 24-28 weeks; rules out GDM later in pregnancy. 	<ul style="list-style-type: none"> - In patients with IGT, IFG: educate on dietary changes to achieve weight loss and/or modifications to carbohydrate intake to achieve blood glucose control to prevent diabetes. - <u>In physician-confirmed cases of diabetes:</u> <ul style="list-style-type: none"> - Educate patients on dietary changes to carbohydrate intake to achieve glucose control. - Collaborate with physician re: recommendations for adjustments to insulin/oral hypoglycaemic agents as required. - Where a delegation exists for RDs to adjust insulin/oral hypoglycaemic agents, adjust levels accordingly and communicate changes to physician and rest of health care team.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Hemoglobin A1c (Hgb A1c) [L093]</p>	<ul style="list-style-type: none"> - Presents an average blood sugar level of previous 3 months. - Monitored in patients with diabetes to determine effectiveness of nutrition care plan and pharmacological regimen for achieving blood glucose control; elevated levels may indicate non-compliance with dietary/pharmacological management warranting modifications to nutrition care plan. - Persistent elevated Hgb A1c levels can lead to diabetic complications (e.g., eye and foot complications, cardiovascular disease, impaired kidney function). - Monitored post-operatively in <i>gastric bypass surgery</i> and liver/lung/kidney/pancreas transplant patients to determine improvements in blood sugar control (many diabetic patients see improvements in blood sugar control following <i>gastric bypass surgery</i> or transplants). - Cancer patients with pre-existing diabetes can experience changes in blood sugar levels during disease progression and/or treatment; physiological stress of cancer and chemotherapy can alter blood sugar control (even in those who are not diabetic); monitored in oncology patients to avoid/correct high blood sugar levels. - Elevated Hgb A1c levels seen in eating disorder patients and athletes who are misusing insulin as a weight-control measure (insufficient insulin administration in type 1 diabetics can prevent weight gain). 	<ul style="list-style-type: none"> - Educate patients on dietary changes to carbohydrate intake to achieve glucose control. - Adjust timing/rate of carbohydrate intake in EN or PN. - Collaborate with physician re: adjustments insulin/oral hypoglycaemic agents. - Where a delegation exists for RDs to adjust insulin/oral hypoglycaemic agents, adjust levels accordingly and communicate changes to physician and rest of health care team.
<p>Fasting Insulin [L325]</p>	<ul style="list-style-type: none"> - Measures amount of circulating insulin in the blood in a fasting state. - Elevated levels are linked to difficulties with weight management and reactive low blood sugar which is common in women with polycystic ovarian syndrome and bulimic patients. 	<ul style="list-style-type: none"> - Provide more intensive nutrition education such as carbohydrate counting or <i>glycemic index</i> approach to achieve blood glucose control. - Collaborate with physician re: need for oral hypoglycaemic agents in polycystic ovarian syndrome patients.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Urinary Ketones [L253]</p>	<ul style="list-style-type: none"> - <i>Ketones</i> are formed when the body breaks down fatty acids for energy leading to a build-up of <i>ketones</i> which can have toxic effects on the body. - Measures whether fatty acids are being broken down for energy in patients with diabetes and in patients with eating disorders to determine compliance with dietary intake. - Monitored in patients with inborn errors of metabolism and those on a ketogenic diet. - Also monitored in high-performance athletes to determine if dietary intake is sufficient to meet energy needs, and/or if patients are ingesting adequate carbohydrate intake or over-training. 	<ul style="list-style-type: none"> - Educate patients on strategies to increase carbohydrate and total calorie intake to meet dietary needs in diabetics and eating disorder patients. - Adjust timing/rate of carbohydrate intake in EN or PN. - In athletes, develop strategies to increase carbohydrate and total energy intake to ensure performance isn't compromised by insufficient energy intake.
<p>Urinary Glucose [code]</p>	<ul style="list-style-type: none"> - Determines spilling of glucose in urine. - Monitored in poorly controlled diabetic patients. 	<ul style="list-style-type: none"> - Educate patients on strategies to modify carbohydrate intake. - Adjust timing/rate of carbohydrate intake in EN or PN. - Collaborate with physician re: adjustments insulin/oral hypoglycaemic agents as required. - Where a delegation exists for RDs to adjust insulin/oral hypoglycaemic agents, adjust levels accordingly and communicate changes to physician and rest of health care team.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>C-Peptide [L346]</p>	<ul style="list-style-type: none"> - A measure of the body's insulin production ability to determine how much insulin is naturally being produced. - Helps guide management of diabetes (e.g., need for more intensive nutrition education re: carbohydrate intake and/or adjustments to insulin therapy). - Monitored to reduce risk of <i>diabetic ketoacidosis</i> and other complications of inadequate insulin production and/or injected insulin. 	<ul style="list-style-type: none"> - Increase patient education re: carbohydrate intake/timing of meals or more intensive education such as carbohydrate counting or <i>glycemic index</i> approach. - Adjust timing/rate of carbohydrate intake in EN or PN. - Collaborate with physician re: adjustments to insulin/oral hypoglycaemic agents as required. - Where a delegation exists for RDs to adjust insulin/oral hypoglycaemic agents, adjust levels accordingly and communicate changes to physician and rest of health care team.
<p>Glucometer Checks (Finger Pricks)</p>	<ul style="list-style-type: none"> - Identifies both low and high blood sugar levels. - Important for monitoring patients who are diabetic, on steroids and those on EN and PN. - Low blood sugar levels can lead to coma and brain injury in critically ill patients. - High blood sugar levels can cause infection, poor wound healing, fluid and electrolyte abnormalities, overfeeding and fatty liver. 	<ul style="list-style-type: none"> - Educate patients on dietary changes to carbohydrate intake to achieve glucose control. - Adjust timing/rate of carbohydrate intake in EN or PN. - Collaborate with physician re: adjustments insulin/oral hypoglycaemic agents as required. - Adjust insulin/oral hypoglycaemic agents where delegation exists and communicate changes to physician and rest of health care team.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
CARDIOVASCULAR DISEASE		
<p>Lipid Panel:</p> <p>Triglycerides [L243] Low Density Lipoprotein (LDL) [code] High Density Lipoprotein (HDL) [L117] Total Cholesterol [L055] Total Cholesterol to HDL Ratio [code]</p> <p>Ordered as a panel, tests can be ordered separately as needed.</p>	<ul style="list-style-type: none"> - Lower LDL, triglycerides, total cholesterol, lower cholesterol to HDL ratio and higher HDL levels are correlated with reduced risk of cardiovascular disease. <p>Lipid panel tests are monitored to:</p> <ul style="list-style-type: none"> - Identify risk, presence, or severity of cardiovascular disease; early detection of cardiovascular disease risk may warrant preventative dietary and lifestyle modifications. - Determine if current dietary interventions are assisting with improved lipid profile target ranges. - Determine if patients with cardiovascular disease, diabetes, and those who are overweight or obese require aggressive lipid dietary management to normalize levels. - Reduce risk of developing cardiovascular disease in chronic kidney disease patients; cardiovascular disease risk increases as kidney function/filtration rate decreases. - Assess lipid levels in patients with pancreatitis, liver disease, NAFLT, NASH, lung/liver/kidney transplants, alcoholism, pancreatitis, and those with spinal cord injury as these patients often experience elevated lipid panel results. - Determine tolerance to fat in patients on a high fat diet (e.g., <i>ketogenic diet</i> and patients with <i>Cystic Fibrosis</i>). <p>In PN patients, triglycerides are closely monitored to:</p> <ul style="list-style-type: none"> - Detect clearance of triglycerides in circulation within the body to reduce risk of pancreatitis induced by high triglyceride levels resulting from poor triglyceride (lipid) clearance. - Identify and prevent fat overload syndrome which can have negative effects on respiratory, vascular and immune systems. 	<ul style="list-style-type: none"> - Lipid panel results will determine level of patient education required: aggressive versus moderate dietary restrictions to normalize lipid levels. - Educate patients to decrease total fat, saturated and trans fat, simple sugars and alcohol intake and increase omega-3 fat and fibre intake. - Educate patients on calorie reduced diet to induce weight loss; weight loss often results in improvements in lipid panel levels. - Adjust EN or PN regimen to reduce calories/ fat/carbohydrate intake and/or induce weight loss. - Collaborate with physician re: need for pharmacological intervention (lipid lowering medication) in patients whose dietary, EN or PN modifications are not demonstrating improvements in lipid panel results.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Homocysteine [code]</p>	<ul style="list-style-type: none"> - An amino acid; high circulating blood levels may indicate increased risk of coronary heart disease, stroke and peripheral vascular disease. - Levels can be influenced by diet; folate, vitamin B6 and vitamin B12 all help break down homocysteine in the body which may result in a lower risk of cardiovascular disease. - Monitored to determine if a person has vitamin B12 or folate deficiency as homocysteine concentration may be elevated before vitamin B12 and folate tests are abnormal. - Also monitored in patients with high cardiovascular disease risk and those with inborn errors of metabolism involving vitamin B12. 	<ul style="list-style-type: none"> - Educate patients on heart healthy diet and to increase folate, vitamin B6 and/or vitamin B12 containing foods, and/or recommend patients take oral vitamin supplements. - Adjust folate, vitamin B6 and/or vitamin B12 to EN or PN. - Collaborate with MD re: need for vitamin B12 injections in suspected cases of malabsorption.
<p>Lipoprotein (a) [code]</p>	<ul style="list-style-type: none"> - Indicative of genetic risk of cardiovascular disease and may play a role in determining adequacy of dietary changes to help improve lipid profiles. 	<ul style="list-style-type: none"> - Lipoprotein (a) along with lipid panel results will determine level of patient education required: aggressive versus moderate dietary restrictions to normalize lipid levels. - Educate patients to decrease total fat, saturated and trans fat, simple sugars and alcohol intake and increase omega-3 fat and fibre intake. - Educate patients on calorie-reduced diet to induce weight loss (as applicable); weight loss often results in improvements in lipid panel levels. - Adjust EN or PN regimen to reduce calories/ fat/carbohydrate intake. - Collaborate with physician re: need for pharmacological intervention (lipid lowering medication) in patients whose dietary, EN or PN modifications are not demonstrating improvements in lipid panel results.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Apolipoprotein-B (Apo-B) [code]</p>	<ul style="list-style-type: none"> - In collaboration with other lipid profile tests, Apo-B helps determine a patient's risk of developing cardiovascular disease. - Typically monitored in patients with a family history of heart disease and/or high lipid levels; may be a better marker of cardiovascular disease risk than LDL cholesterol in high-risk patients. 	<ul style="list-style-type: none"> - In high risk patients, Apo-B along with lipid panel results will determine level of education required: aggressive versus moderate dietary restrictions to normalize lipid levels. - Educate patients to decrease total fat, saturated and trans fat, simple sugars and alcohol intake and increase omega-3 fat and fibre intake. - Educate patients on calorie-reduced diet to induce weight loss (as applicable); weight loss often results in improvements in lipid panel levels. - Adjust EN or PN regimen to reduce calories/ fat/carbohydrate intake. - Collaborate with physician re: need for pharmacological intervention (lipid lowering medication) in patients whose dietary, EN or PN modifications are not demonstrating improvements in lipid panel results.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
EATING DISORDERS		
Urine Specific Gravity [code]	<ul style="list-style-type: none"> - A measure of hydration status. - Often measured in eating disorders to determine if patients are water loading prior to weighing; helps assess compliance with food intake. - Monitored in high-performance athletes and spinal cord injury athletes who have impaired thermoregulatory responses to ensure adequate fluid intake and hydration status. 	<ul style="list-style-type: none"> - Educate patients re: decreasing fluid intake. - Educate patients on strategies to increase carbohydrate and total calorie intake to meet dietary needs in eating disorder patients.
Anion Gap [code]	<ul style="list-style-type: none"> - Used to determine metabolic acidosis; calculated by subtracting the serum concentrations of chloride and bicarbonate from the concentrations of sodium plus potassium. - High levels may indicate starvation with ketone production and/or lack of compliance to dietary intake in eating disorder patients; may also be high due to low magnesium and calcium levels. 	<ul style="list-style-type: none"> - Metabolic acidosis caused by starvation: educate patients on strategies to increase dietary intake. - Adjust calorie/carbohydrate intake in EN or PN. - Metabolic acidosis caused by deficiencies of magnesium and calcium: Educate patients to increase oral calcium and magnesium intake, recommend patients take oral calcium and magnesium supplements, add calcium and magnesium to EN or adjust in PN.
Estradiol [L310]	<ul style="list-style-type: none"> - Predominant female sex hormone. - Normalized levels may be predictive of resumption of menstrual cycles in amenorrhic eating disorder patients, which indicates improved nutritional status. - Low levels may be predictive of early-onset osteoporosis as underweight eating disorder patients are at high risk of osteoporosis. 	<ul style="list-style-type: none"> - Educate patients to increase calcium and vitamin D dietary and/or oral supplement intake. - Increase goal weight if menstrual cycles have failed to resume in eating disorder patients. - Collaborate with physician re: need for bone density testing and/or bone building medications if osteoporosis (or risk for disease) is suspected.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Progesterone [L331]</p>	<ul style="list-style-type: none"> - Naturally secreted by the ovary in the second two weeks of menstrual cycle in ovulating women of reproductive age; monitored to determine if normal ovulation is occurring. - Ovulation often ceased in underweight and in eating disorder patients, may indicate diet low in calories and added fat. 	<ul style="list-style-type: none"> - Educate patients on strategies to increase total calorie and fat intake. - Collaborate with physician re: pharmacological management as required.
<p>Testosterone [Total, L340] [Free, L608]</p>	<ul style="list-style-type: none"> - Predominant male sex hormone; present in females in smaller amounts. - Elevated levels of testosterone seen in female bulimic eating disorder patients who are experiencing excessive food cravings and binge eating; normalizing levels reduces cravings and bingeing. 	<ul style="list-style-type: none"> - Educate patients on strategies to manage food cravings and bingeing. - Collaborate with physician re: need for pharmacological management (e.g., oral contraceptives) to normalize testosterone levels.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
FOOD INTOLERANCES		
<p>Anti-Tissue Transglutaminase (tTG-IgA)</p> <p>[code]</p>	<ul style="list-style-type: none"> - Gluten intolerance screen; determines the body's ability to digest gluten-containing foods; positive test may indicate need for gluten restriction in diet. - <i>Celiac disease</i> can only be confirmed through a small bowel biopsy. - If physician confirms <i>Celiac disease</i> diagnosis, tTG-IGA can be used to monitor compliance to a gluten free diet, especially in patients experiencing gastrointestinal symptoms. - Gluten ingestion in <i>Celiac disease</i> patients can increase risk of osteoporosis, lymphoma, and <i>anemia</i>. 	<ul style="list-style-type: none"> - Positive test would warrant referral of patients to physician to confirm <i>Celiac disease</i> diagnosis through small bowel biopsy. - In patients with positive tests who wish to eliminate gluten in diet rather than confirm <i>Celiac disease</i> diagnosis through biopsy: RD would educate patients to avoid gluten intake. - In physician-confirmed cases of <i>Celiac disease</i>: RD would educate patients to avoid gluten in diet. - Periodic tTG-IgA testing helps identify hidden sources of gluten in diet to help RDs enhance education and strategies for patients to become more compliant with gluten-free diet.
<p>Hydrogen Breath Test for Lactose Intolerance</p> <p>[code]</p>	<ul style="list-style-type: none"> - To confirm/rule-out lactose intolerance and need for lactose restriction in diet. - Lactose intolerance can lead to gas, bloating, diarrhea when lactose containing foods are ingested. - Lactose intolerance can increase risk of developing osteoporosis due to reduced intake of dairy foods and beverages that are high in calcium and vitamin D. - Can also cause patients to avoid many foods and try to self-manage symptoms leading to unbalanced diet and unnecessary food avoidance and fear of foods in eating disorder patients. 	<ul style="list-style-type: none"> - Positive test would warrant need for lactose-restricted diet or lactose-free EN formula. - Educate patients to avoid lactose-containing foods and/or use lactase enzyme supplements. - Education ensures the patient's diet is rich in non-dairy or lactose-free sources of calcium and vitamin D. - Recommend patients take oral calcium and vitamin D supplements if indicated.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Hydrogen Breath Test for Fructose Intolerance [code]	<ul style="list-style-type: none"> - To confirm/rule-out fructose intolerance and need for fructose restriction in diet. - Fructose intolerance can lead to gas, bloating and diarrhea. - Can also cause patients to avoid many foods and try to self-manage symptoms leading to unbalanced diet and unnecessary food avoidance and fear of foods. 	<ul style="list-style-type: none"> - Positive test would warrant need for fructose-restricted diet. - Educate patients on avoiding fructose-containing foods and guidance on balanced diet and/or oral supplement intake to prevent vitamin and mineral deficiencies.
Carnitine (free and total) [code]	<ul style="list-style-type: none"> - Carnitine is a compound made in the body from the amino acids lysine and methionine; required for the transport of long-chain fatty acids into mitochondria and plays a critical role in cellular energy metabolism. - Patients with mitochondrial disorders of fatty acid transport and patients on long-term PN with chronic malnutrition can experience carnitine deficiency which can lead to abnormalities in energy production and lipid tolerance. - Carnitine can also be depleted secondary to medication use (e.g., anti-seizure medication) or as a function of a specific disease (e.g., common in patients with organic acidemias) where carnitine becomes attached with toxic compounds (specific to each disorder) and is excreted in the urine, thereby depleting the overall carnitine levels. - Assessing both total and free carnitine and the ratio between them in the context of long-term malnutrition or ongoing lipid intolerance allows RD to decide whether patients require carnitine supplementation (orally or in EN or PN). - RDs can use total carnitine lab values in part to determine if the diet is adequate in protein and if the patient is utilizing fat for energy adequately. 	<ul style="list-style-type: none"> - Educate patients on foods containing high protein and carnitine content to increase dietary intake. - Educate patients to increase/decrease dietary fat intake. - Adjust protein and fat accordingly in EN or PN. - Collaborate with physician re: need for (or adjustment to) oral carnitine prescription medication or additions to EN or PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Acylcarnitine [code]</p>	<ul style="list-style-type: none"> - Acylcarnitines are a marker of the adequacy of nutritional care in patients with inborn errors of metabolism. - In patients with organic acidemias, acylcarnitines are a marker of organic acid production (from amino acids), as the acids are scavenged and bound to carnitine and therefore measurable through acylcarnitines. - In fatty acid oxidation defects (where long chain fatty acids are restricted in the diet), acylcarnitines are a marker of fatty acids that cannot be utilized by the body (suggesting that intakes of long chain fatty acids exceed needs). - If RDs only ordered carnitine on patients with organic acidemia and found the level to be depleted, they could assume carnitine deficiency; by also checking acylcarnitine levels (routine monitoring in certain metabolic conditions such as organic acidemia and fatty acid oxidation defects), the dietitian would be able to assess if the diet (either the amount of fat or protein being provided) is adequate or excessive. 	<ul style="list-style-type: none"> - Results may indicate presence of protein and fatty acid metabolism disorders warranting RD to modify protein and fat intake in oral diet, EN or PN.
<p>Plasma Fatty Acids [L099]</p>	<ul style="list-style-type: none"> - Important for the formation of healthy cell membranes, proper development and functioning of the brain and nervous system and the production of hormones. - Certain fatty acids are essential, as they cannot be made by the body, and must be obtained from dietary sources; patients on tightly restricted low fat diets (e.g., fatty acid oxidation defects) are at high risk of essential fatty acid deficiency. 	<ul style="list-style-type: none"> - Educate patients on increasing/decreasing fat intake or modifying type of fat intake (e.g., short/long/medium-chain triglycerides). - Adjust fat in EN or PN.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Fecal Fat [L095]	<ul style="list-style-type: none"> - Monitored to assess fat malabsorption. - Fat malabsorption can lead to weight loss and decreased absorption of fat soluble vitamins. 	<ul style="list-style-type: none"> - Educate patients on reducing fat intake or for increasing intake of modified fat foods (e.g., those containing medium-chain triglycerides). - Adjust fat in EN or PN. - Recommend patients take multivitamin supplement to prevent fat-soluble vitamin deficiencies or add multivitamin to EN or adjust components of PN. - Collaborate with physician re: need for (or adjustment to) pancreatic enzymes.
Fecal Elastase 1 [code]	<ul style="list-style-type: none"> - Used to assess pancreatic function in patients with <i>Cystic Fibrosis</i> and chronic pancreatitis. - Knowing if patients are pancreatic insufficient will determine whether patients require pancreatic enzymes. - Identifies patients who require high energy/high fat dietary education. 	<ul style="list-style-type: none"> - Educate patients on consuming high fat/high calorie diet. - Consider high fat/high calorie EN formula. - Increase calorie and fat in PN.
Reducing Substances (Fecal) [code]	<ul style="list-style-type: none"> - Monitored to assess carbohydrate malabsorption. 	<ul style="list-style-type: none"> - Educate patients on limiting/restricting carbohydrate containing foods in diet. - Modify EN formula or adjust carbohydrate in PN solution to limit/restrict carbohydrate intake.
Urinary Organic Acids [code]	<ul style="list-style-type: none"> - Provides a metabolic “snapshot” based on the products the body discards through the urine; indicates by-products of human cellular activity, the digestion of foods, and the metabolism of gastrointestinal flora. - At certain levels, organic acids in urine may be indicators of toxicity or “markers” of metabolic pathways. Metabolites of yeast or gastrointestinal bacteria appear against the background of normal human metabolites and provide an assessment of yeast and bacterial activity in the body. 	<ul style="list-style-type: none"> - Educate patients on limiting/restricting protein containing foods in diet. - Modify EN formula or adjust protein in PN solution to limit/restrict intake.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Quantitative Amino Acids [L013]	<ul style="list-style-type: none"> - Measures circulating amino acids (building blocks of protein) in blood. - Used in patients requiring an amino acid restricted diet (e.g., PKU) to monitor intake of amino acids to determine sufficient protein intake and to verify compliance with restricted dietary intake. - Also a marker of excessive intake of amino acids in the diet which the body is unable to utilize; can contribute to production/build-up of toxic substances (e.g., lactate, organic acids and ammonia). 	<ul style="list-style-type: none"> - Educate patients on appropriate dietary intake of protein and restrictions to amino acid intake (as applicable). - Adjust protein EN or PN solution to meet metabolic needs.
Urinary Amino Acids [code]	<ul style="list-style-type: none"> - A measure of the amount of amino acids in the urine which may indicate presence of inborn errors of metabolism or issues with protein metabolism. - Provides a marker of the body's utilization of amino acids. 	<ul style="list-style-type: none"> - Educate patients on limiting/restricting protein containing foods in diet. - Modify EN formula or adjust protein in PN solution to limit/restrict intake.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
MISCELLANEOUS		
Parathyroid Hormone (PTH) [L330]	<ul style="list-style-type: none"> - Regulates calcium, phosphorus and vitamin D levels in the body - PTH release is controlled by level of calcium in body; PTH increases in attempt to increase calcium levels - Inadequate calcium and vitamin D can cause <i>secondary hyperparathyroidism</i>. - Correcting calcium level may normalize PTH. - Monitored in <i>gastric bypass surgery</i> patients, other patients with gastrointestinal malabsorption as well as chronic kidney disease. 	<ul style="list-style-type: none"> - Educate patients to increase intake of calcium and vitamin D containing foods. - Recommend patients take calcium and vitamin D supplements. - Add calcium and vitamin D to EN or adjust in PN. - Collaborate with physician regarding high-dose vitamin D supplementation, calcium-binding medications and/or phosphate-binding medications.
Thyroid Stimulating Hormone (TSH) [L341]	<ul style="list-style-type: none"> - TSH stimulates the thyroid gland to secrete the hormones thyroxine (T₄) and triiodothyronine (T₃) (see below). - Thyroid gland is dependent on iodine, zinc, and selenium; abnormal levels of these nutrient seen in patients with hyper/hypothyroidism. - Abnormalities seen in malnutrition, eating disorders, Down Syndrome, autism, <i>failure to thrive</i>, genetic disorders, patients on PN. 	<ul style="list-style-type: none"> - Educate patients to increase/decrease intake of iodine, zinc, and/or selenium containing foods. - Recommend iodine, zinc, and/or selenium oral supplements. - Add iodine, zinc, and/or selenium to EN or adjust in PN. - Collaborate with physician re: need for (or adjustment to) thyroid medications.
Thyroxine (T4) & Triiodothyronine (T3) [T3 Total, L336] T4 Total, L338]	<ul style="list-style-type: none"> - Hormones produced by the thyroid gland which are primarily responsible for regulation of metabolism. - Detects functional hypothyroidism secondary to semi-starvation or starvation or high metabolic states. - Helps inform RD re: set-point weight range and treatment decision re: weight and calorie intake goals in anorexic eating disorder patients. 	<ul style="list-style-type: none"> - Educate patients to increase/decrease set-point weight range and increase/decrease calorie intake.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
Plasma Citrulline Level [code]	<ul style="list-style-type: none"> - Monitors functional status of gastrointestinal tract; marker of intestinal absorptive function. - Aids in determining when patients may be ready for transition from PN to EN in <i>short bowel syndrome</i> and/or prognostic indicator of long-term PN dependency in this patient population. 	<ul style="list-style-type: none"> - Collaborate with physician re: determination of most appropriate route of nutrition support (e.g., transition to EN or continue on PN). - Adjust EN formulation and PN solution as required.
Stool for Clostridium-Difficile Culture [code]	<ul style="list-style-type: none"> - Clostridium difficile (C. difficile) is a bacteria that causes diarrhea. C. difficile is one of the most common diarrhea infections in Ontario hospitals and long-term care facilities. - Monitored to rule out infectious cause of diarrhea. 	<ul style="list-style-type: none"> - Negative test would indicate need for RD to modify oral and EN fibre, lactose containing foods/beverages and fluid intake to help decrease frequency/severity of diarrhea and to prevent dehydration. - Positive result would warrant discussion with MD re: pharmacological management of C. difficile.
Interleukin 6 (IL-6) [code]	<ul style="list-style-type: none"> - Secreted by the body to stimulate immune response to trauma, especially burns or other tissue damage leading to inflammation. - Inflammation from acute physical activity can also stimulate IL-6 production which can act in both a pro-inflammatory and anti-inflammatory manner. - IL-6 induces production of hepcidin, an iron-regulatory hormone that when produced may lower iron absorption. 	<ul style="list-style-type: none"> - Helps RD identify iron deficiency caused by trauma/inflammation versus intake or absorption issues. - If inflammation ruled out, RD may recommend dietary intervention (refer to iron panel management above). - Collaborate with physician re: need for medical intervention to alleviate inflammation or underlying medical condition prior to nutrition intervention to correct iron abnormalities.

LAB TEST [CODE]	RATIONALE FOR NUTRITION ASSESSMENT & MONITORING	HOW NUTRITION CARE PLAN WOULD BE MODIFIED BY LAB TEST RESULTS
<p>Hepcidin [code]</p>	<ul style="list-style-type: none"> - A peptide hormone that is released in chronic disease and exercise; a key regulator of iron homeostasis that may reduce iron absorption in the body which may explain high prevalence of iron deficiency in female athletes. - Measurement of hepcidin would help differentiate between iron deficiency <i>anemia</i> of infection/inflammation versus that of a true iron deficiency. 	<ul style="list-style-type: none"> - Helps RD identify iron deficiency caused by trauma/inflammation versus intake or absorption issues. - If inflammation is ruled out, RD may recommend iron dietary intervention (refer to iron panel management above). - Collaborate with physician re: need for medical intervention to alleviate inflammation or underlying medical condition prior to nutrition intervention to correct iron abnormalities.
<p>Blood Gases [code]</p>	<ul style="list-style-type: none"> - Used to evaluate oxygenation and acid-base balance. - Often ordered along with other tests such as electrolytes to determine if an electrolyte imbalance is present, glucose to evaluate blood sugar concentrations, and BUN and creatinine to evaluate kidney function. - Identifies metabolic acidosis secondary to diet restriction/malnutrition or <i>ketogenic diet</i>. 	<ul style="list-style-type: none"> - Adjust amount of carbohydrate, fat and fluid in patients on EN and PN to normalize acid-base balance.
<p>Beta-hydroxybutyrate [L124]</p>	<ul style="list-style-type: none"> - Beta-hydroxybutyrate is a ketone body produced when there is inadequate circulating glucose and fatty acids are broken down for energy. - Monitored in children with epilepsy who are put on a <i>ketogenic diet</i> to control seizures. 	<ul style="list-style-type: none"> - Indicates level of ketone production to determine if dietary glucose restriction is sufficient to help manage seizures. - Collaborate with physician re: dietary management and interactions with seizure medication accordingly.

Abbreviations/Definitions:

Alkalosis: A condition in which the body fluids have excess base (alkali). This is the opposite of excess acid (acidosis).

Anemia: A condition in which the body does not have enough healthy red blood cells. Red blood cells provide oxygen to body tissues. A decrease in red blood cells that occurs when the body cannot properly absorb vitamin B12 from the gastrointestinal tract is called pernicious anemia. Vitamin B12 is necessary for the proper development of red blood cells.

Antioxidant: A substance that has the ability to protect cells in the body against the effects of free radicals. Free radicals are molecules produced when your body breaks down food, or by environmental exposures like tobacco smoke and radiation. Free radicals can damage cells, and may play a role in heart disease, cancer and other diseases.

Ascites: Excess fluid in the space between the membranes lining the abdomen and the abdominal organs.

Calcitriol: The generic name for the prescription medication providing the man-made active form of vitamin D. Calcitriol is used in patients with kidney disease who can't make enough of the active form of Vitamin D (this conversion process is primarily done in the body by the kidneys). This medication is also used to prevent and treat certain types of calcium/phosphorus/parathyroid hormone problems that can happen with long-term kidney dialysis. Calcitriol is usually used along with specific diet recommendations.

Celiac Disease: A digestive disease that damages the small intestine and interferes with absorption of nutrients from food. People who have Celiac disease cannot tolerate gluten, a protein in wheat, rye, and barley.

Cystic Fibrosis: A multi-organ disease, primarily affecting the lungs and digestive system. A build-up of thick mucus in the lungs causes severe breathing problems. It may be difficult to clear bacteria from the lungs, leading to cycles of infection and inflammation, which damage the delicate lung tissues. Thick mucus also blocks the ducts of the pancreas, preventing enzymes from reaching the intestines to digest food. People with Cystic Fibrosis must consume a large amount of artificial enzymes (average 20 pills a day) with every meal and snack, to help digest and absorb adequate nutrition from food.

Diabetic Ketoacidosis: Diabetic ketoacidosis can occur when a person with diabetes has an episode of extreme insulin deficiency. Without adequate insulin, circulating glucose from food is not available as an energy source. The body adapts by breaking down muscle, fat, and liver cells into glucose (sugar) and fatty acids for use as fuel. By-products of fat breakdown, called ketones, build up in the body causing potentially fatal consequences.

EN: Enteral Nutrition. Feeding patients through a tube placed in the nose, the stomach, or the small intestine. Placement depends on functionality of the gastrointestinal tract and duration on tube feed formulation (short-term through a nasogastric tube placed in nose, longer-term through stomach or small intestine).

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Erythropoietin: A hormone that controls erythropoietin, or red blood cell production; can be taken as a therapeutic agent to increase red blood cell production. Often used to treat anemia caused by various conditions, including chronic kidney disease, cancer and other critical illnesses.

Failure to Thrive: A description applied to children whose current weight or rate of weight gain is significantly below that of other children of similar age and sex.

Gastrectomy: Surgical removal of all or part of the stomach; used to treat bleeding, inflammation, or benign or cancerous tumours.

Gastric Bypass Surgery: Surgical techniques in severely overweight or obese patients; patients feel full more quickly, reducing the amount of food eaten, resulting in weight loss. In Ontario, the roux-en-y procedure is most commonly performed. In roux-en-y *gastric bypass*, the stomach is made smaller by creating a small pouch at the top of the stomach using surgical staples or a plastic band. The smaller stomach is then connected directly to the middle portion of the small intestine (jejunum), bypassing the rest of the stomach and the upper portion of the small intestine (duodenum). Sleeve gastrectomy is performed only if the roux-en-y procedure can't be done for medical reasons. In sleeve gastrectomy, the stomach is reduced to around 15% of its original size by permanent surgical removal of a large portion of the stomach.

Glycemic Index (GI): A measure of the effects of carbohydrates on blood sugar levels. Carbohydrates that break down quickly during digestion and release glucose rapidly into the bloodstream have a high GI. A lower glycemic index suggests slower rates of digestion and absorption of the foods' carbohydrates. GI teaching may help manage glucose levels in patients with diabetes.

High-Output Ostomies: Ostomies are openings in the abdomen from the small or large bowel in which intestinal waste passes out of the opening and is collected in an external pouching system stuck to the skin. Some patients with ostomies experience high rates of output which can include fluids, vitamins, minerals, electrolytes and can experience dehydration and other complications.

Ileostomy: Opening in the abdomen from the last section of the small bowel. Intestinal waste passes out of the ileostomy and is collected in an external pouching system stuck to the skin. Procedure is performed in patients that have undergone removal of their large intestine from inflammatory bowel disease and/or cancer.

Inflammatory Bowel Disease: Refers to two chronic diseases that cause inflammation of the intestines: ulcerative colitis and Crohn's disease. Ulcerative colitis is an inflammatory disease of the large intestine, or colon. Crohn's disease differs from ulcerative colitis in the areas of the bowel it involves – it most commonly affects the last part of the small intestine (called the terminal ileum) and parts of the large intestine. However, it isn't limited to these areas and can attack any part of the digestive tract. Crohn's disease causes inflammation that extends much deeper into the layers of the intestinal wall and generally tends to involve the entire bowel wall, whereas ulcerative colitis affects only the lining of the bowel.

Ketones: Substances that are made when the body breaks down fat for energy.

Ketogenic Diet: A high-fat, low carbohydrate and adequate protein diet that is used to treat difficult-to-control epilepsy in children. The diet mimics aspects of starvation by forcing the body to burn fats rather than carbohydrates for energy. Normally carbohydrates contained in foods are converted into glucose, transported around the body as an energy source and are particularly important in fuelling brain function. In a ketogenic diet, with very little carbohydrate intake, the liver converts fat into fatty acids and ketones. Ketones pass into the brain and replace glucose as an energy source. An elevated level of ketones in the blood, a state known as ketosis, can lead to a reduction in the frequency of epileptic seizures.

Long-Term Bowel Rest: No food or water by mouth. Patients may be receiving intravenous fluids and/or parenteral nutrition.

NAFLD: Non-Alcoholic Fatty Liver Disease. Occurs in patients who do not consume excessive amounts of alcohol, yet they present in a similar way to what can be seen in liver disease that is due to excessive intake of alcohol (e.g., fatty liver).

NASH: Non-Alcoholic Steatohepatitis. Next stage of NAFLD that involves the accumulation of fat in the liver cells as well as inflammation of the liver.

Paracentesis: A procedure to drain fluid out of the belly through a long thin needle.

PKU: Phenylketonuria. A genetic disorder that is characterized by an inability of the body to utilize the essential amino acid phenylalanine. Patients must be counselled to stay away from dietary sources of phenylalanine which includes avoiding meat, chicken, fish, eggs, nuts, cheese, legumes, cow milk and other dairy products as well as the artificial sweetener aspartame which contains phenylalanine.

Refeeding Syndrome: Usually occurs within four days of starting to feed patients who have been malnourished or who have had little nutrient intake for prolonged periods of time. Patients can develop fluid and electrolyte disorders along with neurologic, pulmonary, cardiac, neuromuscular, and hematologic complications.

Secondary Hyperparathyroidism: When the body produces extra parathyroid hormone because calcium levels are too low. This is seen when vitamin D levels are low or when calcium is not absorbed from the intestines. Correcting calcium and/or vitamin D levels will bring the parathyroid levels in the normal range.

Short Bowel Syndrome: A malabsorption disorder caused by the surgical removal of the small intestine. Short bowel syndrome usually does not develop unless more than two thirds of the small intestine has been removed. Also termed short gut syndrome or short gut.

SIADH: Syndrome of inappropriate antidiuretic hormone hypersecretion. Characterized by excessive release of antidiuretic hormone that results in the abnormal handling of water intake by the body. It is usually treated with fluid restriction. Diuretics may also be given to decrease reabsorption of water, but care must be taken not to correct water imbalances too rapidly.

PN: Parenteral Nutrition. Intravenous feeding that provides all or part of a patient's nutrient requirements. PN differs from a standard intravenous (IV) solution as administration requires a larger vein (through placement of a peripheral or central venous catheter) to sustain the higher volume and concentration of solution that is administered. There are two types of PN: Peripheral Parenteral Nutrition (PPN) and Total Parenteral Nutrition (TPN). PPN is administered via the peripheral venous route but in lower concentrations than TPN. PPN may be partial; this means that patients may be getting nutrition from other sources (IV or oral intake) along with the PPN. PPN is often administered in patients who require short-term use, modest nutrient needs when patients may have some functionality of intestinal tract and are consuming oral intake, and/or where there are contraindications to central vein access. TPN is administered via central venous access that allows for higher rates and concentrations of the PN solution. TPN is provided when patients do not receive any other form of nutrition and is administered over longer time periods than PPN. TPN is typically administered in patients experiencing severe digestive disorders (e.g., flare-ups of inflammatory bowel disease) and patients having extended consequences of surgery, accidents or other trauma.

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