FOOD N° 5 3/08

nutri pro®

Nestlé Professional Nutrition Magazine

VITAMINS: THE ORCHESTRA FOR THE BODY

CONTENTS

Nestlé PROFESSIONAL

VITAMINS: the orchestra for the body

EDITORIAL

Dear all
"Make science tangible"!
NutriPro is doing exactly that: it is transforming science into tangible nutrition value for customers. I personally think NutriPro is a great tool for our Nestlé Professional community to leverage nutrition, health and wellness in an easy and understandable way. NutriPro is widely used for educational and communication purposes by all our employees and customers.
NutriPro has become well-known in the nutrition community in the last two years. We work continuously to improve our magazine, to add value to your business, and we are grateful for your feedback. Nutrition, health and wellness are everyone's business and are what our company cares about. We hope you have an enriching reading experience.

Werner Bauer, Executive Vice President
Chief Technology Officer

Dear Reader
Vitamins are essential to our health. They fulfil many functions within the human body and are involved in almost every process. They nevertheless belong to our most critical nutrients, because they are essential.
This NutriPro offers you information about the sources and functions of the different vitamins. Especially important for your daily work are tips on how to prepare a meal rich in vitamins, as well as on minimising vitamin loss during preparation and processing/cooking.

Sascha Türler-Inderbitzin, NESTLÉ PROFESSIONAL
Strategic Business Division

What are vitamins?

Vitamins are complex organic substances necessary to our diet in small amounts to promote and regulate the chemical reactions and processes (growth, reproduction, and health maintenance) carried out in the human body. Usually only a few milligrams (mg) or even micrograms (µg) are needed per day, but even these small amounts are essential for good health. 13 substances have currently been identified as vitamins. All but two of them cannot be produced by our bodies, so they must be provided through our daily diet. Exceptions are vitamin D, which can be obtained from sunlight on skin, and niacin (B vitamin), small amounts of which can be made from an amino acid (tryptophan).

Classification of vitamins

Based on their solubility in fat or water, vitamins are grouped into two categories: fat-soluble and water-soluble vitamins. This characteristic affects how they are absorbed, transported, stored within, and excreted from the body:

Fat-soluble vitamins
Vitamin A
Vitamin D
Vitamin E
Vitamin K

Water-soluble vitamins
Vitamin B_1 (Thiamin)
Vitamin B_2 (Riboflavin)
Vitamin B_6 (Pyridoxine)
Vitamin B_{12} (Cobalamin)
Folic Acid
Niacin
Pantothenic Acid
Vitamin C (Ascorbic Acid)
Biotin

GOOD TO KNOW

Bioavailability

Bioavailability (sometimes mistakenly called absorption rate) is a general term that refers to how well a nutrient (e.g. vitamins) can be absorbed **and** used by the body. It is affected by the following:

- The composition of individual foods, e.g. vitamin C (e.g. from potatoes) increase the bioavailability of iron from non-haem sources such as plants (vegetable sources), e.g. spinach.
- Diet as a whole, e.g. dietary fat is necessary for the absorption of fat-soluble vitamins.
- Conditions in the body; some vitamins require specific substances (molecules) in order to be absorbed, or specific transport systems in the blood to travel to the tissue where they are needed. For example, vitamin B_{12} (e.g. from meat) must be bound to a protein (intrinsic factor) produced in the stomach before it can be absorbed in the intestine. If this protein is not available, adequate amounts of vitamin B_{12} cannot be absorbed.

GOOD TO KNOW

We need enough, but not too much of each vitamin

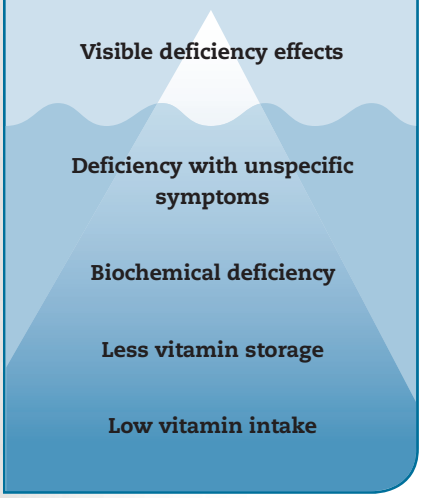
The right amounts and combinations of vitamins are essential to our health. Important is:

- The recommendations for daily intake should be achieved as an average amount over a week. These recommendations may be used as target values and to help us to choose a varied diet.
- An insufficient intake of vitamins over a short period of time doesn't always lead to a deficiency. But insufficient intake over longer periods may cause a clinical deficiency. The different steps towards clinical deficiency can be illustrated by an iceberg: like the iceberg, the only visible part of a deficiency is the peak (latest phase). The prior steps that led to the symptoms remain hidden.

On the other hand, more is not always better. For some vitamins, we have so-called Tolerable Upper Intake Levels (ULs), which indicate the highest amount a healthy person can consume without the risk of toxicity. Examples: niacin has a UL of 35mg; vitamin E has a UL of 1000mg. These upper levels are reached by consuming a lot of fortified foods and using supplements in an uncontrolled way.

GOOD TO KNOW

Vitamin deficiency



A quick guide to fat-soluble vitamins

Vitamin A

Major functions in the body:

- Essential for skin and mucous membranes.
- Required for reproduction (e.g. cell differentiation), growth and immunity.
- Necessary for normal vision/eyesight (note: night blindness is one of the first and more easily reversible symptoms of vitamin A deficiency).

Sources:

Vitamin A is found in two forms in our diet:

- As **retinol** (vitamin A) in foods from animal sources, e.g. liver, whole milk, butter, cheese, fish (e.g. salmon).
- As **carotenoids** (ß-carotene is the most common) in foods from plants, e.g. carrots, tomatoes, dark green leafy vegetables (e.g. spinach), sweet potatoes, mangos, cantaloupes. Beta carotene and some other carotenoids are called vitamin A precursors or provitamins, because they can be converted into vitamin A within the body.

Note: Many breakfast cereals, juices, dairy products and other foods are fortified with vitamin A.

Tips for serving a meal rich in vitamin A:

- 200g of vegetables such as carrots, tomatoes or spinach, or 140g of green salad provide the daily recommendation for an average adult.
- If you serve vitamin A-rich food, use a small amount of oil (e.g. canola or sunflower oil) – this increases the bioavailability of carotenoids and is also a good source of vitamin E.

Vitamin D

Major function in the body:

- Essential for the absorption of calcium and phosphorous ➔ that is necessary for growing and maintaining bones and teeth.

Sources:

- Fatty fish (e.g. salmon, tuna), egg yolks, liver.
- Foods fortified with vitamin D such as margarine, milk, yogurt, breakfast cereals.

Note: Vitamin D can also be synthesised by the action of sunlight on precursors of Vitamin D (sterols) already in the skin.

Tip for serving a meal rich in vitamin D:
- One serving of tuna (100g), one slice of smoked salmon (30g), two eggs or 30g of margarine provide the daily recommendation for an average adult.

Vitamin E

Major function in the body:
- Protects cells and cell membranes from damage through oxidation (acts as an antioxidant).

Sources:
- Plant oils, such as canola, sunflower or soybean oil.
- Nuts, almonds, peanuts, sunflower seeds.
- Leafy green vegetables (e.g. spinach, mustard greens), eggs.

Tips for serving a meal rich in vitamin E:
- Regularly use a high quality vegetable oil, e.g. canola, sunflower or soybean oil.
- Store these oils in a dark bottle for no more than 3 months.
- Do not heat high-quality vegetable oils too high, and store them in a dark place to prevent oxidation.
- Use native oils for salads – they contain more vitamin E.
- Use nuts or seeds (around 50g is the daily recommendation) as toppings for salads – but be careful: they are high in calories, use them in moderation. They may also provoke allergic reactions in sensitive individuals.
- Serve whole-grain bread or pasta whenever possible.

Vitamin K

Major functions in the body:
- Needed for blood clotting.
- Helps to build up bones.

Sources:
- Green leafy vegetables, e.g. cabbage, spinach, broccoli.
- Fruits, e.g. kiwis, apricots.
- Eggs, dairy products.

Tips for serving a meal rich in vitamin K:
- 1 cup of raw broccoli (around 90g), 60g of spinach (cooked) or 190g of okra (cooked) provide the daily recommendation for an average adult.
- As vitamin K is very sensitive to light, vitamin K-enriched food should be stored in a dark place.

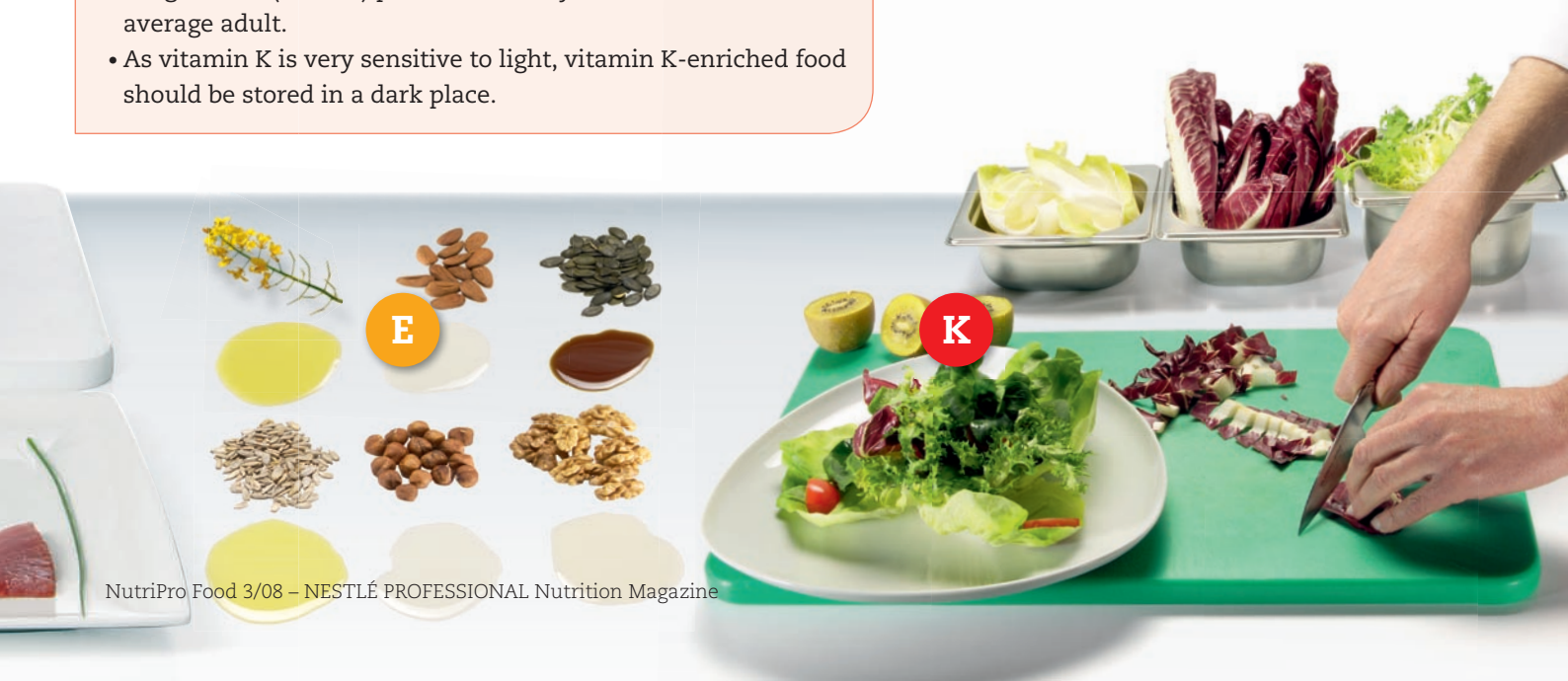
GOOD TO REMEMBER

Term definition

Here are the explanations for terms often used in connection with vitamins:
- **Fortification:** A term generally used to describe the addition of nutrients to foods, such as the addition of vitamin D to milk or margarine.
- **Antioxidant:** A substance (e.g. vitamin E) that is able to neutralise reactive oxygen molecules known as free radicals e.g. generated by normal oxygen requirements or a reaction to cigarette smoke, and which protects the body from oxidative damage.
- **Coenzymes:** Small non-protein organic molecules that act as carriers and are necessary for the proper functioning of many enzymes.

GOOD TO REMEMBER

Vitamins	Recommended Intake for adults (USA)
A	700–900µg/day
D	5–15µg/day
E	15mg/day
K	90–120µg/day



Tips for serving a vitamin-rich meal

The amount of a vitamin in a food depends on:

- The amount found naturally in that food (see below).
- Factors such as temperature, light, oxygen, acid and alkali affect the stability of vitamins.
- How the food is processed. Some processing steps such as canning vegetables or drying fruits can cause vitamin loss. However, other processing steps such as fortification (e.g. milk with vitamin D, cereals with vitamin B_{12}) add vitamins back into foods.

Stability

Vitamin	Acid (low pH)	Alkali (high pH)	Heat (>70° C)	Light	O_2
C	●	●	●	●	●
B_6	●	●	●	●	●
Folic Acid	●	●	●	●	●
A	●	●	●	●	●
D	●	●	●	●	●
E	●	●	●	●	●

● no effect ● sensitive ● very sensitive

GOOD TO KNOW

Fresh or frozen vegetables – which is better?

A comparison of the nutritional value of fresh and frozen vegetables partially offers better results for the frozen products. Depending on transportation and storage time (at the supplier, in cold storage, in the kitchen), fresh vegetables can show a high level of loss in some vitamins. Deep-frozen products are mostly farm-fresh; this means they are immediately deep-frozen after harvesting with no storage, which optimally preserves the vitamins. Because they are subject to more processing and a longer storage time, canned vegetables have a lower vitamin content than fresh or frozen vegetables. When using canned vegetables or other vegetables, it is important to follow supplier's recommendations for preparation to minimise vitamin loss and ensure the most gentle cooking method possible.

IN GENERAL

- **Keep to the "5 A Day" rule, every day. Five servings of fruits and vegetables is the minimum number a person should aim for a day. Some examples for a serving size are:**
  - One medium-sized fruit (ex. apple, orange, banana, pear)
  - 1/2 cup of raw, cooked, canned or frozen fruits or vegetables
  - 3/4 cup (6oz) of 100% fruit or vegetable juice
  - 1/2 cup cut-up fruit
  - 1/2 cup cooked or canned legumes (beans and peas)
  - 1 cup of raw, leafy vegetables (ex. lettuce, spinach)
  - 1/4 cup dried fruit (ex. raisins, apricots, mango)
- **In daily practice (examples):**
  - Offer a fresh component (e.g. fresh fruits for breakfast, salad or steamed vegetables for lunch or dinner) for every meal.
  - Offer only 100% vegetable or fruit juice.
  - Serve vegetable or fruit sticks with different kinds of dips for take-away.
- Serve a wide range of vegetables – in all the colours of the rainbow.

PURCHASING AND STORING VEGETABLES AND FRUITS

- **Offer seasonal fresh fruits and vegetables every day – they have more vitamins and taste.**
- **Try to use regional vegetables and fruits ➔ vitamins are lost during transportation: e.g. the vitamin content of ripe bananas differs from that of bananas picked unripe and processed with chemicals during transportation.**
- **In general, keep vegetables and fruits covered and refrigerated during storage to prevent rapid vitamin loss (exception: sweet potatoes, winter squash and vegetables which are sensitive to low temperature).**
- **High humidity during storage is essential.**
- **Do not store fruits and vegetables in the kitchen too long ➔ Guide time: fruits: 4–5 days, vegetables/salads: 2–3 days.**
- **Even with deep-frozen vegetables, follow the guide for storage time ➔ Guide time: 3–6 months.**
- **Blanching prevents vitamin loss during storage.**

PROCESSING/COOKING FRUITS AND VEGETABLES

- **Serve fruits and vegetables raw whenever possible.**
- **The best cooking methods for vegetables are steaming, stewing/braising and pressure cooking.**
- **Braise, bake, or broil meats instead of frying.**
- **Cook with the lid on.**
- **Use the cooking liquid whenever possible.**
- **Cook for the shortest possible time.**
- **Cook until just tender, not mushy.**
- **Cooked vegetables should be quickly heated to 70° C (158° F) to destroy enzymes which threaten the vitamins.**
- **The quick defrosting of fruits and vegetables decreases vitamin loss.**
- **Serve immediately ➔ keeping food warm causes a vitamin C loss of 4–17% within one hour and 7–34% within two hours.**
- **If you use frozen vegetables:**
  - Don't thaw them before cooking.
  - Heat the water first, then add the vegetables.
  - If you use them for cold dishes, cook them thoroughly beforehand.
  - Use the microwave for heating them.
- **If you use canned vegetables:**
  - Use the juice to cook the vegetables in.
  - Never boil canned vegetables.
  - Use the microwave for heating them.
  - Avoid excessive stirring while warming them up.

TIPS FOR PREPARING FRUITS AND VEGETABLES

- **Wash vegetables (and fruits) under running water whole and before peeling.**
- **Cutting vegetables into large pieces prevents vitamin loss.**
- **Cover fruits and vegetables immediately after cutting to prevent vitamin loss through light and air.**

A quick guide to water-soluble vitamins

Vitamin B_1 (Thiamin)

Major functions in the body:
- Releases energy from carbohydrates.
- Important for the brain and nervous system.

Sources:
- Lean cuts of pork, green peas, beef, whole grain products, fish (e.g. tuna), lentils, potatoes.

Note: Most ready-to-eat and instant-prepared cereals are fortified with thiamin.

Tips for serving a meal rich in vitamin B_1:
- 150g of pork or 125g of hamburger (beef) together with 200g of green peas or 3.5oz of cod, together with 1 cup of white rice and 2 cups of asparagus provide the daily recommendation for an average adult.
- Serve enriched or whole-grain pasta or rice every day and do not wash before cooking or rinse after cooking.
- Serve potatoes (with herbs and a minimum of salt) and legumes in several variations as often as possible.
- Roast meat at a moderate temperature and cook only until it is done – overcooking at a high temperature destroys thiamin.

Vitamin B_2 (Riboflavin)

Major function in the body:
- Releases energy, especially from fat and protein.

Sources:
- Milk, dairy products, liver, lean meats, dark green leafy vegetables, mushrooms, fish (e.g. mackerel), eggs.

Note: Fortified cereals.

Tips for serving a meal rich in vitamin B_2:

- A 150g veal cutlet, together with 200g of mushrooms or 200g of spinach, together with 2 scrambled eggs and 200g of sweet potatoes, provide the daily recommendation for an average adult.
- Serve low-fat milk and low-fat dairy products every day – store the milk in an opaque cardboard container, because riboflavin is extremely sensitive to light.
- Serve or offer salt-water fish if possible.

Vitamin B_6 (Pyridoxine)

Major functions in the body:

- Essential in protein metabolism and the nervous system.
- Necessary for red blood cell formation and function.

Sources:

- Chicken, pork, turkey, fish (e.g. coalfish), vegetables (e.g. green beans, spinach), nuts, lentils, fruits (e.g. bananas), potatoes, whole grain products.

Tip for serving a meal rich in vitamin B_6:

- A 150g chicken breast, together with 200g of sweet potatoes or 3 bananas, provide the daily recommendation for an average adult.

Vitamin B_{12} (Cobalamin)

Major function in the body:

- Necessary for the proper formation of blood cells and nerve fibres/central nervous system.

Sources:

- Found only in animal products such as liver, meat, most fish, yogurt, cheese.
- Exception: sauerkraut.

Tip for serving a meal rich in vitamin B_{12}:

- For a vegetarian meal: dairy products, milk and eggs, e.g. 300g of yogurt and 2 slices (together 80g) of cheddar cheese and one egg provide the daily recommendation for an average adult.

GOOD TO KNOW

Fruits and vegetables – with 1000 air miles?

There have been some news reports over the last few years that have indicated a decrease in vitamins in fruits and vegetables at the time they are bought. Some background information: Vitamin content depends on several factors, such as soil nutrients, climate, harvesting times and the type of fruit or vegetable. For example, the vitamin C content of a fruit or vegetable varies not only between different types of apples, but also between apples of the same type, depending on harvesting time and region. This is one reason for the different nutrient values in different countries. A comparison of specific foods over a period of 50 years shows that the vitamin content of our food has remained quite constant on average. In addition to origin, the original vitamin content, transportation, storage, preparation and cooking are all essential for the final amount of "vitamins on the plate".

GOOD TO KNOW

Vitamins	Recommended Intake for adults (USA)
B_1	1.1–1.2mg/day
B_2	1.1–1.3mg/day
B_6	1.3–1.7mg/day
B_{12}	2.4µg/day

VITAMINS: the orchestra for the body

Folic Acid

Major functions in the body:
- Essential for the growth and reproduction of all body cells.
- For the formation of red blood cells.
- Especially important for women of childbearing age.

Sources:
- Green leafy vegetables (e.g. turnip greens, spinach, butter lettuce), broccoli, asparagus, corn, tomatoes, fruits (e.g. oranges), lentils, kidney, navy, or pinto beans, soybeans, green peas.
- Liver, whole grain, sunflower seeds, peanuts.
- Most enriched grain products.

Tips for serving a meal rich in folic acid:
- One glass (150ml/6oz) of orange juice, 200g of broccoli or 200g of asparagus (e.g. for lunch) and 200g of spinach (e.g. as a salad with an olive oil dressing for dinner) provide the daily recommendation for an average adult.
- Use enriched grain products (e.g. pasta, rice, bread) whenever possible.
- Serve/offer wheat germ and soybean sprouts as toppings for salads.
- Folic acid is extremely sensitive to heat and light ➔ prepare food rich in folic acid very carefully, or serve it raw or as salad, e.g. tomatoes, cucumber, cabbage.

Niacin

Major functions in the body:
- Helps metabolise protein, carbohydrates and fat.
- Releases energy from them.

Sources:
- Lean meat, beef, fish such as tuna, salmon, cod, and halibut, chicken, liver, peanuts, dairy products, eggs.
- Enriched grain products.

Tips for serving a meal rich in niacin:
- 150g of beef or 200g of herring or 4oz of tuna are good sources for the daily recommendation.
- Use sunflower seeds or peanuts as toppings for salads.
- Create a salad based on red lentils with marinated chicken strips and a high-quality vegetable oil (includes high levels of vitamin E).

Pantothenic Acid

Major function in the body:

- Coenzyme in numerous chemical reactions that sustain life, e.g. generating energy, synthesis of essential fats, synthesis of hormones.

Sources:

- Liver, meat, fish (e.g. shellfish, herring), egg yolk, broccoli, legumes, avocado, sweet potatoes, mushrooms, whole grains.

Vitamin C (Ascorbic Acid)

Major functions in the body:

- Formation of collagen ➔ used in the structure of connective tissue and bone.
- Healing wounds.
- Antioxidant.

Sources:

- Citrus fruits, berries (e.g. cranberries, blueberries, raspberries, strawberries), melons, green and red peppers, tomatoes, potatoes, broccoli.

Tips for serving a meal rich in vitamin C:

- One glass (150ml/6oz) of orange juice or a large orange or 1 cup of sweet red pepper (60g) or 1 cup of broccoli (100g) or 150g of strawberries provide the daily recommendation.
- It is the most unstable vitamin – under heat, light and oxygen – so be very careful during storage and cooking.
- Add a little lemon juice or vinegar to slow down vitamin C loss.

GOOD TO KNOW

Vitamins	Recommended Intake for adults (USA)
Folic Acid	400µg DFE/day
Niacin	14–16mg NE/day
Pantothenic Acid	5mg/day
Vitamin C	75–90mg/day

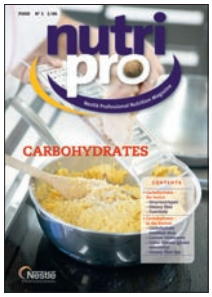
QUIZ

1. **How many vitamins have currently been identified?**
   - **U** 12
   - **V** 13
   - **W** 14
2. **Vitamin A is a:**
   - **I** Fat-soluble vitamin
   - **J** Water-soluble vitamin
3. **Vitamin D is necessary for:**
   - **R** The skin
   - **S** The immune system
   - **T** For bone/teeth mineralisation
4. **A source of vitamin K is:**
   - **A** Spinach
   - **B** Oil
   - **C** Liver
5. **Vitamin B_1 is also called:**
   - **L** Riboflavin
   - **M** Thiamin
   - **N** Niacin
6. **Folic acid is essential for:**
   - **G** Metabolising protein
   - **H** Healing wounds
   - **I** Human growth
7. **Good sources of ascorbic acid are:**
   - **N** Cranberries
   - **O** Dairy products
   - **P** Herring
8. **Vitamin E is sensitive to**
   - **N** Acid
   - **B** Light
   - **P** Heat

1	2	3	4	5	6	7	8

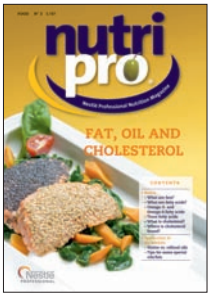
Answer: VITAMIN B

NutriPro Food current magazines

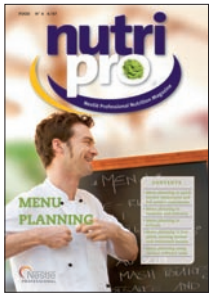


NutriPro Food
Nr. 1
Carbohydrates

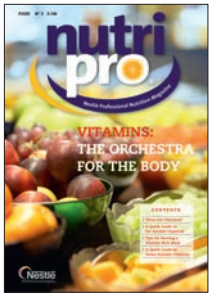
NutriPro Food
Nr. 2
Cooking Methods



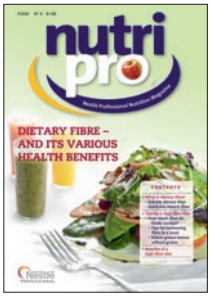
NutriPro Food
Nr. 3
Fat, Oil and Cholesterols



NutriPro Food
Nr. 4
Menu Planning



NutriPro Food
Nr. 5
Vitamins:
The Orchestra
For The Body

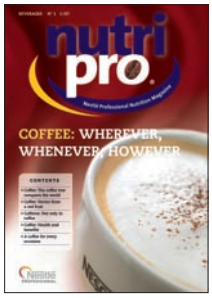


NutriPro Food
Nr. 6
Dietary Fibre –
and Its Various
Health Benefits

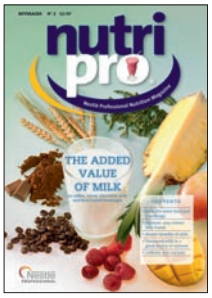
Next edition

NutriPro Food
Nr. 7
Menu for Kids
Q1/2009

NutriPro Beverages current magazines



NutriPro Beverages
Nr. 1
Coffee: Wherever,
Whenever, However



NutriPro Beverages
Nr. 2
The Added Value
of Milk

NutriPro Beverages
Nr. 3
Cocoa and Malt

Next edition

NutriPro Beverages
Nr. 4
Tea and Its Health
Benefits
Q2/2009

NESTLÉ PROFESSIONAL
Nestec S.A.
Avenue Nestlé 55
1800 Vevey
Switzerland