BETTER DIETS, BETTER HEALTH

Legumes and Starchy Foods

Briefing Paper 3

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CONSUMPTION OF LEGUMES AND STARCHY FOODS

SUMMARY

This Briefing Paper is the third of a series of papers entitled 'Better Diets, Better Health.'

Food systems are the source of many problems and of their solutions. We have to shift our consumption to more protective foods that are intended to dramatically reduce human disease and enhance planetary sustainability.

Our intention in this briefing paper is to explain the role of the consumption of legumes and starchy foods in promoting 'protective diets'. How can better diets protect us from the burden of non-communicable diseases? Unfortunately, the cause-effect pathways are often unclear. Does consuming legumes improve or impair our health? Perhaps surprisingly, the evidence suggests the there is little or no evidence that health is impaired!

Terms such as legumes, pulses, and beans are often used interchangeably, but they actually refer to different elements of the plant. A *'legume'* is the whole plant; a *'pulse'* is the edible seed from a legume plant. Amongst the pulses, we can find beans, lentils, and peas. The pea pod is a legume, but the *pea* inside the pod is the pulse.

Legumes contain several components that, when eaten as part of a balanced, plant-rich diet, may help prevent cardiovascular disease, cancer, diabetes, and obesity. According to the *Harvard School of Public Health*, legumes may protect us against cardiovascular disease, cancer, diabetes, and obesity.

The risks to human health from consuming legumes have been examined in several meta-analysis and cohort studies.

In summary:

1. The consumption of legumes reduces coronary disease.
2. But the evidence of links between legumes and cancer protection is inconclusive.

3. There is some evidence of reduced risk of diabetes when legumes are consumed but not when soyabeans are consumed.
4. There is a reduction in body weight for people who eat beans.

Nevertheless, the *2019 EAT-Lancet* report that outlines a 'planetary health diet' recommends consuming 50 grams of legumes (about ¼ cup) daily.

Legumes are a relatively sustainable crop. They release up to seven times less greenhouse gas emissions per area than other crops and can sequester carbon in soils. They can also make their own nitrogen from the atmosphere, thus reducing the application of nitrogen fertilizers. This leaves nitrogen-rich residues in the soil after harvesting; a benefit for the next crop planted in its place.

In many respects, starchy foods are more complicated than legumes and their consumption has significant positive as well as negative influence on health.

Major sources of starch are varied and abundant. Included are cereal grains such as wheat, barley, rice and corn, and the seeds of the legumes such as beans, garden peas, chickpeas, and pulses. An important source are tubers such as potato, sweet potato, ginger, turmeric, and groundnuts as well as immature fruits and vegetables.

Starch is produced by all green plants and is abundant in leaves, stems, fruits, seed, tubers, and roots of various plants. When required, starch is broken down, in the presence of certain enzymes and water, into its constituent units of glucose, which diffuse from the cell to nourish the plant tissues.

Fundamentally, starch is a carbohydrate consisting of numerous glucose units joined by glycosidic bonds. Most starches are composed of two kinds of polysaccharide, a linear form called amylose, and a form with branches called amylopectin. However, a comprehensive review of the role of amylose concludes that despite the widespread occurrence of amylose in plants, its physiological role or adaptive significance is not known.

Sixty to seventy percent of the caloric intake of humans comes from starch. It has had a considerable role in the evolution of culture. Starch is one of the three major bio-renewable materials found on the planet, sucrose and cellulose being the other two. Of these, starch is today the most important because of its relative abundance and the ease with which it can be transformed to glucose.

Starchy foods are a good source of energy and nutrients. As well as starch, they contain fibre, calcium, iron and B vitamins. Some people think starchy foods are fattening, but gram for gram they contain fewer than half the calories of fat.

Fibre is the name given to a range of substances found in the cell walls of vegetables, fruits, pulses, and cereal grains. Fibre that cannot be digested helps other food and waste products to move through the gut. Potato skins, wholegrain bread and breakfast cereals, brown rice, and wholewheat pasta are all good sources of this kind of fibre. Some types of fibre found in fruits and vegetables such as apples, carrots, and potatoes, and in oats and pulses can be partly digested and may help reduce the amount of cholesterol in human blood.

The consumption of fibre is especially high in African regions and may present both, risks and health benefits. Notably, in Eastern and Western SSA where the intakes of legumes are over the optimal range. Intakes of whole grains are just above the global level, and fibres are well above, in both cases, above the levels in North America.

From the above arguments, it is clear that a direct link between starchy foods and health is not easily demonstrable. However, it is possible to make the link in terms of carbohydrates.

In summary:

- There is no association between total carbohydrate intake and the incidence of colorectal cancer, cardiovascular disease, type 2 diabetes, and other non-communicable diseases.
- Sugar, or sugar-sweetened beverage intake is not associated with the incidence of colorectal cancer and there is insufficient evidence for a link to cardiovascular disease. There is also no link between the incidence of type 2 diabetes mellitus and total, or individual sugars intake, although there is a greater risk associated with a higher intake of sugar-sweetened beverages.
- Moreover, the WHO has made a strong recommendation that in adults and children the intake of free sugars should be reduced to less than 10% of total energy intake and a recommendation for a further reduction intake to below 5% of total energy intake.
- Starch and refined grain intake are not associated with cardiovascular disease and type 2 diabetes mellitus and there is a lack of evidence

relating these to colorectal cancer. There is also insufficient evidence for a link between starch intake and weight gain.

- A diet rich in dietary fibre are associated with a lower incidence of cardiovascular diseases, coronary events, type 2 diabetes mellitus and colorectal cancer. As more dietary fibre is consumed, the risk is reduced. There appears to be no association between dietary fibre intake and body weight. However, higher whole grains and cereal consumption is associated with a lower incidence of cardiovascular disease, hypertension, type 2 diabetes mellitus and colon cancer.
- A diet higher in glycemic index or load is associated with a greater risk of type 2 diabetes mellitus, but there is no evidence of an association between glycemic index and cardiovascular disease or coronary heart disease. There is also no evidence of an association between glycaemic index or load and colorectal cancer incidence.
- The dietary reference value for total carbohydrate should be maintained at an average population intake of approximately 50% of total dietary energy.

Finally, high levels of acrylamide in food potentially increase the risk of developing all types of cancer in all age groups. Acrylamide is present in starchy food, created when many foods, particularly starchy foods like potatoes and bread, are cooked for long periods at high temperatures, such as when baking, frying, grilling, toasting, and roasting. Potatoes and root vegetables should be boiled or steamed to reduce the risk of acrylamide. Potatoes should not be stored in the refrigerator but stored in a dark, cool place at temperatures above 6° Centigrade.

POLICY PRIORITIES

There is a need for further research into the links between:

i. Legume consumption and the prevention of ill health.

ii. The role of amylose amylopectin in plants, and their physiological roles.

iii. The negative effects of consuming starchy foods (for example, potatoes in the form of French fries), lack of whole grains in bread, cereals, and rice.

iv. The health risks of reheated rice.

v. The role of high levels of dietary fibre in East African diets.

vi. The dangers of high levels of acrylamide in foods, and the risk of developing all types of cancer in all age groups.

BACKGROUND

Eating and drinking have profound effects on our health, lives, and communities. Much of what we eat is not good for us *or* for the planet. We consume many foods that appear to contribute to poor health and increase mortality. Moreover, producing these foods substantially contributes to the overuse of pesticides and fertilisers, the depletion of water reserves, soil erosion and emissions of greenhouse gases.

The Rockefeller Foundation initiative that funds our work has the objective of countering these trends, in part by shifting food consumption towards diets that protect against non-communicable diseases.[1]

Eating is an intimate act, and several times each day we think, even superficially, about what we are eating. *'You are What you Eat'* is a phrase from the influential 18th century French gastronome, Jean-Anthelme Brillat-Savarin, author of the classic, *The Physiology of Taste.*[2] Today, it is even more pertinent, being that evidence is accumulating that our dietary intake is likely to be unhealthy for us.

PHOTO 1. COLOURS OF TURKEY ON UNSPLASH

[1] Flor, R. 2019. The Rockefeller Foundation. Focusing on "Protective Foods" to Reduce the Global Burden of Disease. Available from: https://www.rockefellerfoundation.org/blog/focusing-protective-foods-reduce-global-burden-disease/ (Accessed: 22.04.20)

[2] "Tell me what you eat: I will tell you who you are". Quote attributed to Jean Anthelme Brillat-Savarin (1755-1826), French lawyer and politician, well-known for his work as an epicure and gastronome. Wikipedia, The Free Encyclopedia. Available from: https://en.wikipedia.org/wiki/Jean_Anthelme_Brillat-Savarin (Accessed: 06.04.20)

LEGUMES

Food systems are the source of many problems, and of their solutions. We have to shift our consumption to more protective foods that are intended to dramatically reduce human disease and enhance planetary sustainability.

Our intention in this briefing paper is to explain the role of consumption of legumes and starchy foods in promoting 'protective diets' – how can better diets protect us from the burden of non-communicable diseases?

The Rockefeller Foundation's *Theory of Change* model[3] is essentially a set of hypotheses: consumption of certain foods in our diets results in improvements in human health, notably, the reduction in the incidence of serious diseases such as cancers, cardiovascular disease, and diabetes. However, the cause-effect pathways are often unclear. Does consuming legumes or starchy foods, improve or impair our health?

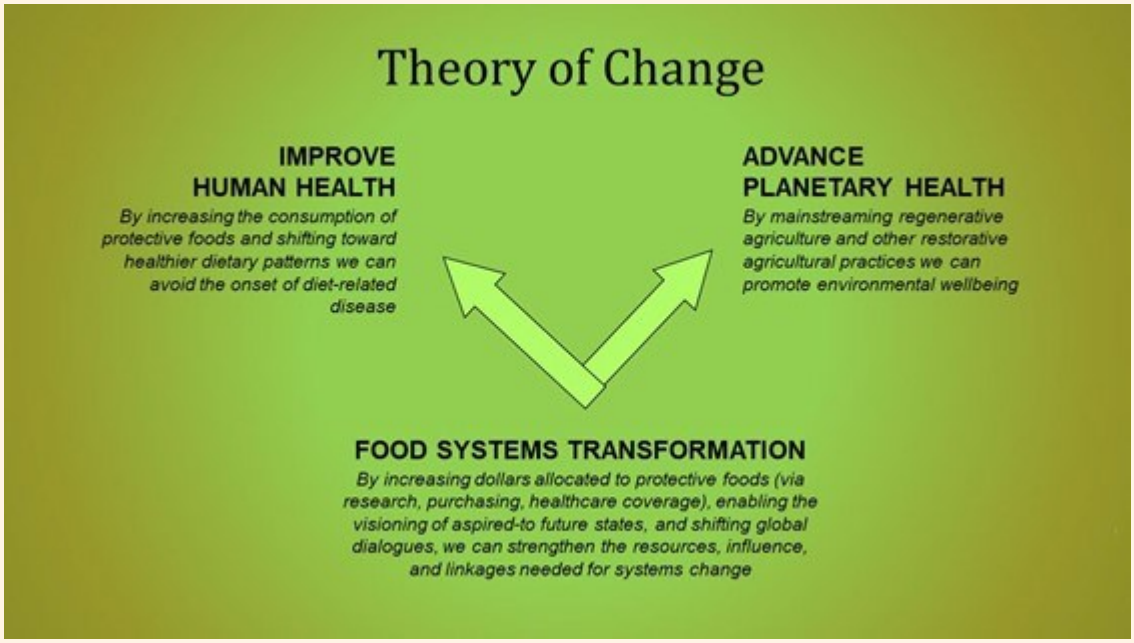


Figure 1. Adapted from The Rockefeller Foundation's *Theory of Change* model.

[3] Courtesy of The Rockefeller Foundation. Reused with permission.

The terms *legumes*, *pulses*, and *beans* are often used interchangeably, but they are distinct:
A '*legume'* refers to the whole plant; a '*pul*se' is the edible seed from a legume plant, and pulses include beans, lentils, and peas. For example, a *pea pod* is a legume, but the *pea* inside the pod is the *pulse*.

Legumes contain several components that, when eaten as part of a balanced plant-rich diet, may help prevent cardiovascular disease, cancer, diabetes, and obesity.

Despite their wide variety, legumes share many common benefits. They are relatively sustainable and inexpensive; they have a low-glycaemic index and are rich in protein and fibre. They are also satiating. Because of their "meaty" texture, legumes can even stand in for animal-based protein foods in a variety of preparations. Moreover, their generally neutral flavour makes them versatile; they can blend well with other ingredients and can easily be combined with various seasonings.

THE PROTECTION LEGUMES GIVE US

According to the *Harvard School of Public Health*, for the most part, legumes can protect us against severe chronic disease:[4]

- **Cardiovascular Disease**
    a. Fibre, folate, and phytochemicals in legumes may benefit heart health.
    b. When whole and unprocessed, legumes are low in saturated fat and sodium.
    c. The fibre in legumes may help to lower blood cholesterol.
    d. Consuming legumes may prevent sharp rises in blood sugar.

[4] Harvard T.H. Chan School of Public Health. The Nutrition Source: *Legumes and Pulses*, *The Nutrition Source*. 2019. Available at: https://www.hsph.harvard.edu/nutritionsource/legumes-pulses/ (Accessed: 09.06.21).

- **Cancer**
    a. The fibre, phytochemical, and mineral content of legumes may have anti-cancer effects.
    b. A high-fibre diet has been associated with a reduced risk of colorectal cancers.
    c. On the minus side, the evidence from human studies on legumes and cancer protection is relatively weak.

- **Diabetes**
    a. Legumes have a low glycaemic index, are high in fibre, and contain slow-digesting resistant starch—all of which may be beneficial to prevent diabetes.
    b. But there is not yet a definitive answer that legumes help in the prevention of type 2 diabetes or the lowering of blood glucose. Trials have not been conclusive.

- **Obesity**
    a. Dietary components of legumes may help promote weight loss.
    b. Protein and soluble/insoluble fibre content of legume diets may increase feelings of fullness and modestly increase calorie expenditure.

The 2019 *EAT-Lancet* report that outlines a **'planetary health diet'** recommends to eat 50 grams of legumes (about ¼ cup) daily.

THE RISKS TO HEALTH FROM CONSUMING LEGUMES

The risks to human health from consuming legumes have been examined in several meta-analysis and cohort studies (Box 1)

Box 1. The risks to human health in meta-analyses and cohort studies.[5]

Coronary Heart Disease

- Eating legumes about 4 times weekly was associated with a 14% reduced risk of coronary artery disease.
- Intakes of pulses lowered fasting total cholesterol by about 7% and LDL ("bad") cholesterol by 6%, whereas it raised HDL ("good") cholesterol by 2.6%.
- After 19 years, people who ate legumes 4 times or more a week had a 22% lower risk of heart disease and 11% lower risk of cardiovascular diseases than those who ate legumes less than once weekly.
- Substitution of legumes for red meats reduced risk factors for cardiovascular disease.

Cancers

- The fiber, phytochemical, and mineral content of legumes may have anti-cancer effects according to animal and cell studies.
- A recommendation of at least 30 grams of dietary fibre daily, been associated with a reduced risk of colorectal and other cancers.
- But in general, the evidence from human studies of links between legumes and cancer protection is not conclusive.

Diabetes

- A cohort study of 36,000 older women from the U.S. free of diabetes at baseline found that after 6 years of follow-up, no significant association with diabetes risk was found when comparing those who ate the most soybeans with those eating the least.
- Another cohort study of 65,000 7 middle-aged women in China without diabetes at baseline found that after 4.5 years, those who ate the most

[5] Harvard T.H. Chan School of Public Health. The Nutrition Source: *Legumes and Pulses*, *The Nutrition Source*. 2019. Available at: https://www.hsph.harvard.edu/nutritionsource/legumes-pulses/ (Accessed: 09.06.21).

legumes (about 1/3 cup daily) compared with the least had a 38% reduced risk of type 2 diabetes.

Obesity

- A study using data on over 8,000 adults from the National Health and Nutrition Examination Survey found that people who ate beans had a lower body weight and smaller waist size than people who did not eat beans.

According to the FAO[6], drought-resistant species of legumes can be of particular benefit to dry environments where food security is often a challenge. They can also help minimize **food waste**, since pulses can be dried and stored for relatively long periods of time without losing their nutritional value.[7]

STARCHY FOODS

In many respects, starchy foods are more complicated than legumes and their consumption has significant positive as well as negative influence on health.

WHAT IS STARCH?

Starch is produced by all green plants and is abundant in leaves, stems, fruits, seed, tubers, and roots of various plants. Photosynthesis results in the production of starch that is then stored in the plant chloroplasts in the form of granules, for example, in the roots of the cassava plant, potato tubers, the stem pith of sago or the seeds of corn, wheat and rice. When required, starch is broken down, in the presence of certain enzymes and water, into its constituent units of glucose which diffuse from the cell to nourish the plant tissues. In humans and in other animals, starch from plants is broken down into its constituent sugar molecules, which then supply energy to the tissues.[8]

[6] Food and Agriculture Organisation of the United Nations. See: FAO.org.
[7] Harvard T.H. Chan School of Public Health. See: https://www.hsph.harvard.edu/nutritionsource/legumes-pulses/
[8] https://www.britannica.com/science/starch

Major sources of starch are varied and abundant. These are cereal grains such as wheat, barley, rice and corn, and the seeds of the legumes such as beans, garden peas, chickpeas, and pulses. An important source are tubers such as potato, sweet potato, ginger, turmeric, and groundnuts as well as immature fruits and vegetables.[9]

Fundamentally, starch is a carbohydrate consisting of numerous glucose units joined by glycosidic bonds (Box 2).

Box 2. The Chemical Structure of Starch[10]

Most starches are composed of two kinds of polysaccharide, a linear form called amylose, and a form with branches called amylopectin.

Amylose possesses a α1–4 glycosidic linkage.

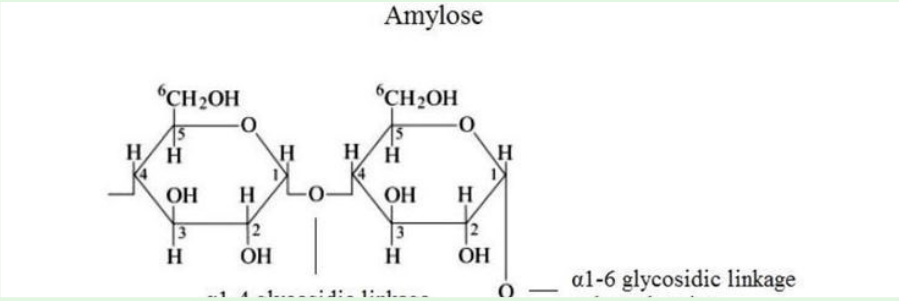


Figure 1. Structure of Amylose.

Amylopectin possesses a structure with α1–4 as well as α1–6 glycosidic linkages.

[9] Nawaz, H. et al. 2020 Physical and chemical modification in starch structure and reactivity. Books, Google.com; DOI: 10.5772/intechopen.88870

[10] Nawaz, H. *et al.* 2020. Physical and Chemical Modifications in Starch Structure and Reactivity, Chemical Properties of Starch. Martins Emeje, *IntechOpen.* DOI: 10.5772/intechopen.88870. Available from: https://www.intechopen.com/books/chemical-properties-of-starch/physical-and-chemical-modifications-in-starch-structure-and-reactivity

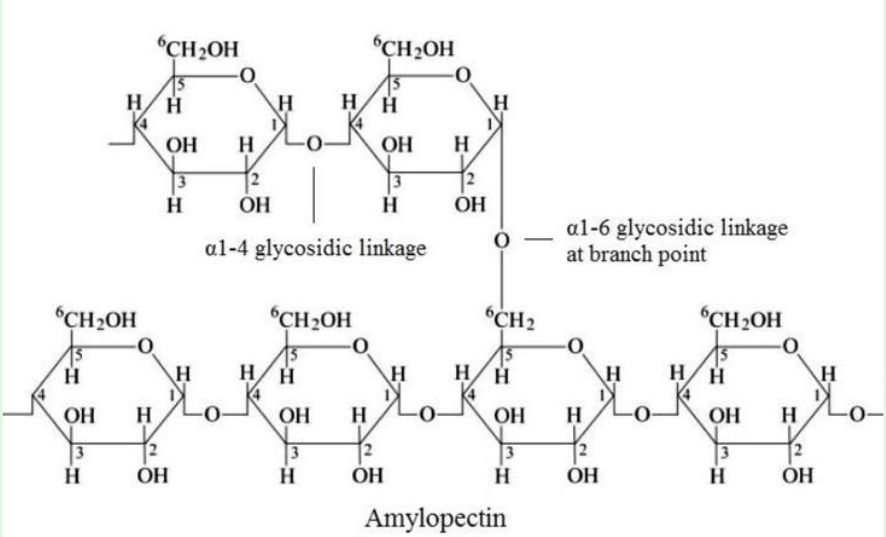


Figure 2. Structure of Amylopectin.

Source for figures 1 and 2: Nawaz, H. et al., 2020[11] Available from: https://www.intechopen.com/chapters/68720

However, in a comprehensive review of the role of Amylose, Dr David Seung of the Department of Metabolic Biology at the John Innes Centre in Norwich, UK, concludes that despite the widespread occurrence of amylose in plants, its physiological role or adaptive significance is not known. For example, amylose- free varieties of wheat, barley, rice, potato, and cassava have similar growth characteristics and comparable yields to normal varieties. In the case of amylose, wild plants that do not produce amylose revives a long-standing question of why starch granules contain amylose, rather than amylopectin alone. Professor David Seung believes that ecological approaches may reveal the adaptive advantage of producing amylose.[12]

[11] Source: Nawaz, H. et al. 2020. Physical and chemical modifications in starch structure and reactivity. In Emeje, M. (ed.) Chemical Properties of Starch. Figures © 2020 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution 3.0 License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

[12] Seung, D. 2020 Amylose in starch: towards an understanding of biosynthesis, structure and function. *New Phytologist* 228:1490-1505

Sixty to seventy percent of the caloric intake of humans comes from starch. It has had a role in the evolution of culture. Besides being used as an essential food, wheat starch facilitated writing with ink on papyrus, especially in Egypt and China. The Romans, around 100BC, used starch to whiten cloth and to powder hair and they often mixed dyes to colour the cloth. Coloured starches were used as cosmetics.[13] Starch is one of three major bio-renewable materials found on the planet, sucrose and cellulose being the other two. Of these, starch is today the most important because of its relative abundance and the ease with which it can be transformed to glucose. Glucose is used industrially in the formation of glucose syrups, high-fructose syrups, a variety of maltodextrins with a wide average molecular weight, cyclomaltodextrins, d-glucitol (d-sorbitol) as well as the formation by fermentation of ethanol, acetic acid, d-lactic acid, and other organic compounds.

PHOTO 2. BRANDS&PEOPLE ON UNSPLASH

[13] Robyt J. 2008 Starch: Structure, Properties, Chemistry, and Enzymology. In: Fraser-Reid B.O., Tatsuta K., Thiem J. (eds) Glycoscience. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-30429-6_35

STARCH IN FOODS

Starchy foods are a good source of energy and nutrients. As well as starch, they contain fibre, calcium, iron, and B vitamins. Some people think starchy foods are fattening, but gram for gram, they contain fewer than half the calories of fat.

Wholegrain varieties of starchy foods and potatoes, particularly when eaten with their skin on, are good sources of fibre.

Fibre is the name given to a range of substances found in the cell walls of vegetables, fruits, pulses, and cereal grains. Fibre that cannot be digested helps other food and waste products to move through the gut. Potato skins, wholegrain bread and breakfast cereals, brown rice, and wholewheat pasta are all good sources of this kind of fibre. Some types of fibre found in fruits and vegetables – such as apples, carrots, potatoes – and in oats and pulses can be partly digested and may help reduce the amount of cholesterol in your blood.

Box 3. Types of Starchy Foods.[14]

Potatoes

Potatoes are an excellent choice of starchy food and a good source of energy, fibre, B vitamins Bs and potassium. Potatoes also provide a great deal of our vitamin C. They are a healthy choice when boiled, baked, mashed, or roasted, with only a small amount of fat or oil and no added salt. However, French fries and other chips cooked in oil or served with salt are not a healthy choice.

Bread

A healthy balanced diet incudes bread, especially wholemeal, granary, brown and seeded varieties. Wholegrain, wholemeal, and brown breads provide energy and contain B vitamins, vitamin E, fibre, and a wide range of minerals. White bread has less fibre than wholegrain, wholemeal, or brown bread.

Cereal products

Wholegrain cereals can contribute to our daily intake of iron, fibre, B vitamins and protein. Wheat, oats, barley, rye, and rice are commonly available cereals that can be eaten as wholegrains. Including higher-fibre options can also provide a slow release of energy. Thus, cereal products consisting of oats or

[14] https://www.nhs.uk/live-well/eat-well/starchy-foods-and-carbohydrates/?tabname=food-and-diet

oatmeal, such as porridge, and wholewheat products are healthy breakfast options. But many cereal products in the UK are refined, with low wholegrain content. They can also be high in added salt and sugar.

Rice and grains

Rice and grains are an excellent choice of starchy foods. They provide energy and are low in fat. Carbohydrates such as rice and grains (particularly brown and wholegrain varieties) can contain:

- Fibre, which can help your body get rid of waste products.
- B vitamins, which help release energy from the food you eat and help your body work properly.

There are a few precautions you should take when storing and reheating cooked rice and grains. This is because the spores of some food poisoning bugs can survive cooking.

If cooked rice or grains are left standing at room temperature, the spores can germinate. The bacteria multiply and produce toxins that make you be sick (vomit) and have diarrhoea. Reheating food will not get rid of these toxins.

Pasta

Pasta is another healthy option. It consists of dough made from durum wheat and water and contains iron and B vitamins. Whole wheat or wholegrain are healthier than ordinary pasta, as they contain more fibre. We digest wholegrain foods slower than refined grains, so they can help us feel full for longer.

So far, we have examined diets that are adopted on a national or even world-wide scale, with a strong scientific provenance. However, we believe there is a role for more regional or locally based diets that have potentially valuable features. We need to explore regional diets that aim to achieve the same benefits, are culturally acceptable and use local locally accessible ingredients.

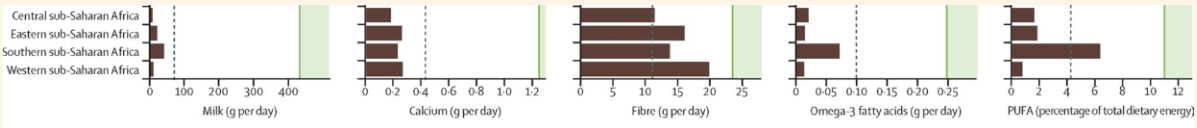
EAST AFRICA

Starchy foods, especially those containing fibre, are a major component of African diets. The data below are taken from the Global Burden of Disease Study 2017 and extracted from Figure 1 of that report, providing figures for African regions and the US.[15]

Note that the graphs in the figures for fibre and other intakes shown below, show the actual intake levels (dashed line) and the recommended intake levels in grams per day (dashed green line). The desired level of intake is the level of risk exposure that minimises the risk from all causes of death.

High Income North America

Central, Eastern, Southern and Western sub-Saharan Africa.



Figures 3 and 4. Intake of fibre and other intakes for High Income North America and the African regions

Source (Fig. 3 and 4): Adapted from Afshin, A. et al. 2019. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Figure 1. The Lancet 393, 1958–1972. Available from: https://doi.org/10.1016/S0140-6736(19)30041-8

The consumption of fibre is especially high in African regions and may present both health benefits and risks. Notably, in Eastern and Western SSA the intakes of legumes are in excess of the optimal intake. Intakes of whole grains are just above the global level, and fibres are well above the global level, in both cases, above the levels in North America.

There will be economic benefits to East African governments and societies if the intakes of healthy foods are increased and the intakes of unhealthy foods decreased, so protecting us from cancers, cardiovascular diseases, and diabetes.

[15] Afshin, A. et al. 2019. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study. 2017. Suplementary appendix. The Lancet, 393(10184), pp. 1958–1972. Available from: https://ars.els-cdn.com/content/image/1-s2.0-S0140673619300418-mmc1.pdf (accessed 13.10.20)

THE HEALTH RISKS OF CARBOHYDRATES

From the above arguments, it is clear that a direct link between starchy foods and health is not practicable. However, it is possible to make the link in terms of carbohydrates.

CARBOHYDRATES AND HEALTH[16]

Carbohydrates are derived from starchy foods.

Box 4. Carbohydrates and Health.

Cohort studies and randomised controlled trials indicate the following relationships:

A. Total Dietary Carbohydrate

1.There is no association between total carbohydrate intake and the incidence of colorectal cancer, cardiovascular disease, type 2 diabetes, and other diseases.[17]

B. Sugars

2. Sugars, or sugar-sweetened beverages intake are not associated with the incidence of colorectal cancer. There is also no association between the incidence of type 2 diabetes mellitus and total or individual sugars intake, but a greater risk is associated with a higher intake of sugar-sweetened beverages. There is insufficient evidence for the relation to cardiovascular disease.[18]

3. The WHO made a strong recommendation that in adults and children the intake of free sugars should be reduced to less than 10% of total energy intake and a recommendation for a further reduction intake to below 5% of total energy intake.

[16] Scientific Advisory Committee on Nutrition and Health, 2015 *Carbohydrates and Health.* The Stationary Office, Norwich, UK.
[17] Section 5.148 in Scientific Advisory Committee on Nutrition (SACN). 2015 *Carbohydrates and Health* London: The Stationary Office
[18] 12.9 SACN

C. Starchy Foods

4. Starch and refined grain intake is not associated with cardiovascular disease and type 2 diabetes mellitus and there a lack of evidence relating colorectal cancer. There is also insufficient evidence for a link between starch intake and weight gain.[19]

D. Dietary Fibre

5. Diets rich in dietary fibre are associated with a lower incidence of cardiovascular diseases, coronary events, type 2 diabetes mellitus and colorectal cancer. As more dietary fibre is consumed the risk was reduced. There was no association between dietary fibre intake and body weight. However, higher whole grains and cereal consumption is associated with a lower incidence of cardiovascular disease, hypertension, type 2 diabetes mellitus and colon cancer.[20]

E. Glycaemic Index

6. A diet higher in glycemic index or load is associated with a greater risk of type 2 diabetes mellitus, but there is no evidence of an association between glycemic index and cardiovascular disease or coronary heart disease. There is also no evidence of an association between glycaemic index or load and colorectal cancer incidence.[21]

F. Dietary Carbohydrate

7. The dietary reference value for total carbohydrate should be maintained at an average population intake of approximately 50% of total dietary energy.

ACRYLAMIDES - THE RISK OF CANCER

According to the European Food Safety Authority high levels of acrylamide in food potentially increased the risk of developing all types of cancer in all age groups.[22] Acrylamide is present in starchy food, created when many foods, particularly starchy foods like potatoes and bread, are cooked for long periods at high temperatures, such as when baking, frying, grilling, toasting, and

[19] 12.13 SACN
[20] 8.160 &12.15 SACN
[21] 10.58 SACN
[22] https://www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet

roasting. Instead of frying or roasting potatoes and root vegetables, they should be boiled or steamed to reduce the risk of acrylamide. Potatoes should not be stored in the refrigerator but stored in a dark, cool place at temperatures above 6° Centigrades.

CONCLUSION

The consequences of legume and starchy food-based diets are mixed. There is good evidence that the consumption of legumes reduces coronary disease and there is some evidence of reduced risk of diabetes when legumes are consumed but not for soyabeans. Significantly, the evidence of links between legumes and cancer protection is inconclusive.

For starchy foods a direct link to a health outcome is not practicable, but it is possible to make a link in some cases with carbohydrates. However:

- There is no association between total carbohydrate intake and the incidence of colorectal cancer, cardiovascular disease, type 2 diabetes, and other diseases.
- Sugar or sugar-sweetened beverage intake is not associated with the incidence of colorectal cancer and there is insufficient evidence for a link to cardiovascular disease. There is also no link between the incidence of type 2 diabetes mellitus and total or individual sugars intake, although there is a greater risk is associated with a higher intake of sugars-sweetened beverages.
- Moreover, the WHO has made a strong recommendation that in adults and children the intake of free sugars should be reduced to less than 10%

of total energy intake and a recommendation for a further reduction intake to below 5% of total energy intake.

- Starch and refined grain intake is not associated with cardiovascular disease and type 2 diabetes mellitus and there a lack of evidence relating colorectal cancer. There is also insufficient evidence for a link between starch intake and weight gain.
- Diets rich in dietary fibre are associated with a lower incidence of cardiovascular diseases, coronary events, type 2 diabetes mellitus and colorectal cancer. As more dietary fibre is consumed the risk was reduced. There was no association between dietary fibre intake and body weight. However, higher whole grains and cereal consumption is associated with a lower incidence of cardiovascular disease, hypertension, type 2 diabetes mellitus and colon cancer.
- A diet higher in glycemic index or load is associated with a greater risk of type 2 diabetes mellitus, but there is no evidence of an association between glycemic index and cardiovascular disease or coronary heart disease. There is also no evidence of an association between glycaemic index or load and colorectal cancer incidence.
- The dietary reference value for total carbohydrate should be maintained at an average population intake of approximately 50% of total dietary energy.

PHOTO 3. SHELLEY PAULS ON UNSPLASH