EAS Journal of Biotechnology and Genetics
Abbreviated Key Title: EAS J Biotechnol Genet
ISSN: 2663-189X (Print) & ISSN: 2663-7286 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-4 | Issue-3 | May-Jun-2022 | DOI: 10.36349/easjbg.2022.v04i03.002

Review Article

An Overview; Unleashing the Health-Beneficial Progress of Turnip *(Brassica rapa)*

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Article History
Received: 29.03.2022
Accepted: 06.05.2022
Published: 30.06.2022

Journal homepage: https://www.easpublisher.com

Quick Response Code

Abstract: Vegetables are considered to be an important part of a balanced diet. Particularly, the brassica vegetables many of them are leafy and green, add significant visual or esthetic attractiveness to a meal. Rapeseed and mustard; most important dicotyledonous, cross pollinated and cool season vegetable crop. Rapeseed oil is considered to have useful influence on human healt. It is suitable for patients suffering from several diseases or to control diseases. Its fatty acid profile along with other components might justify its beneficial impact. The local production of edible oil from all sources could not compete with the growing demand of population. There are many reseasons for low rapeseed production, such as labor and agricultural inputs availability due to the increasing costs. It is grown mainly for root throughout the country. Despite of its wide cultivation the average seed yield is rather low. Limited attention has been paid towards scientific method of good quality root and seed yield.

Keywords: Health-Beneficial, Vegetables, Rapeseed, fatty acid.

INTRODUCTION

The cultivation of brassica plants can be traced back to 1500 BC according to archeological records practice (Prakash, 1980). The genus Brassica is consiting of main oilseeds, vegetables, and forage crops. Turnip (*Brassica rapa* L.) belongs to family Crucifereae. It has been cultivated in a vast range of climate from west Europe to China and from Norway to the African desert since about 2000 years ago (Zohary and Hopf, 2000).

Rapeseed and mustard; most important dicotyledonous, cross pollinated and cool season vegetable crop. It is usually grown for both roots and the foliage. It is used for several purposes in Pakistan. Besides its consumption for human it is also used as feed for animals. In 100 gram of turnip bulb, almost 0.12 % Fat, 34 calories, 2.2 % fibers, 7.84 % carbohydrates, no cholesterol and 1.10 % protein are present (Susan, 2010). Its roots could either be used as salad, pickled, raw or semi-cooked. They are main source of about 92.3% water, 0.8% protein, 0.2% fats, 6% carbohydrates and 0.7% ash (Thompson, 1957).

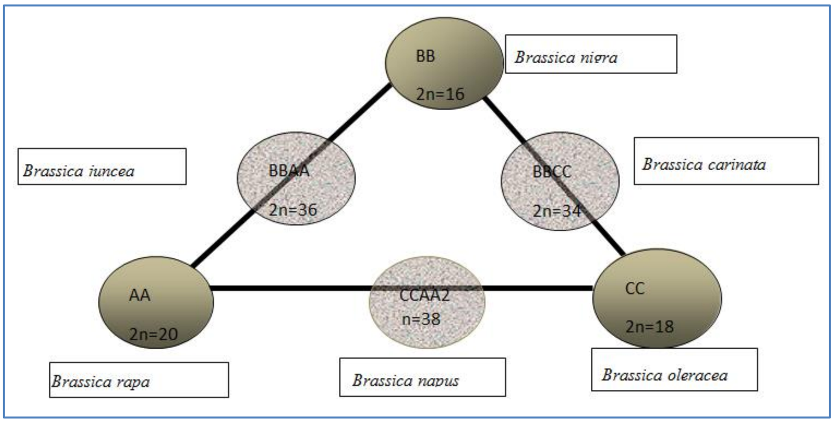

Fig-1.1: Evolutionary relationships of *Brassica* species

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Since, Pakistan is an agricultural country. It is spending billion dollars on the import of edible oil that is a major constraint on the economy of the country. The local production of edible oil from all sources could not compete with the growing demand of population. In 2021, 2.917 million tonnes of edible oil of value Rs 574.199 billion was imported. Local production of edible oil during this period is estimated at 0.374 million tonnes. Total availability of edible oil from all sources is estimated at 3.291 million tonnes. The total cultivated area of turnip in Pakistan was 0.608 hectares with total oil production of 0.108 million tons, along with 0.338 per hectare average yield (Anonymous, 2021-22). The production of turnip per hectare is very low in Pakistan as compared to other countries. It is important cool weather vegetable crop of Pakistan and especially in Khyber Pakhtunkhwa. It is grown mainly for root throughout the country. Despite of its wide cultivation the average seed yield is rather low. Limited attention has been paid towards scientific method of good quality root and seed yield.

Nutritional and Biologically Active Compounds in Brassica Vegetable Crops

Vegetables; considered to be an important part of a balanced diet. Particularly, the brassica vegetables many of them are leafy and green, add significant visual or esthetic attractiveness to a meal.

Brassica crops contain low content of calories, fats and a high content of water. They contain essential amino acids, and many mineral elements. The high value of Brassica crops for human nutrition, their highly value is primarily indicated by the prescence of biologically active compounds as enzymes, pigments and secondary metabolites (Manchali *et al.*, 2012). Their main constitutents are calcium, provitamin A, vitamin C, and certain beneficial phytochemicals. Due to prescence of distinctive flavors and textures, its palatability in the eyes of many consumers increases. They also prodding them to wax poetic and pose severe negative emotions in others, (Fahey, 2003; Singh *et al.*, 2010). Brassicas are also main source of metabolites as glucosinolates, flavonoids and other minor compounds (Manchali *et al*., 2012; Neugart *et al*., 2018).

There are many reseasons for low rapeseed production, such as labor and agricultural inputs availability due to the increasing costs. Ultimately it leads to lower outputs, yield instability due to climate variability, and weak cultivars (shatter, biotic and abiotic factors). Rapeseed contains about 92.3% water, 0.8% protein, 0.2% fats, 6% carbohydrates and 0.7% ash. It is mainly known as a source of edible and industrial oil, as well as protein.

Useful effects of Rapeseed Oil on Health

Rapeseed oil is considered to have useful influence on human healt. It is suitable for patients suffering from several diseases or to control diseases. Its fatty acid profile along with other components might justify its beneficial impact. Based on fatty acid profile, it contains lesser content of saturated fats, higher level of a high level of MUFA (oleic acid) and PUFA (omega–3 and omega–6). Its oil contains high content of tocopherols and phytosterols. Since, saturated fats are essential; body can synthesize them so intake of supplements might be useless or their intake must be low (<10% of total calories) (Lupton *et al*., 2002). The level of saturated fats is fortunately less than 7% that could fulfil the intake recommendation. The level of unsaturated fatty acids (UFA) in the blood could affect the lipid levels, so intake must be proper. It was reported that UFA could affect human blood lipids positively as compared to SFA (Mensink *et al*., 2003).

The beneficial effects of Brassica vegetables on human health have been partially linked to these Phytochemicals are consided to have useful effects on health that may act at different and complementary levels. Among all, its oil increase enzymes detoxification, reduce oxidative stress that directly increases the effeciency of immune system (Boivin *et al*., 2009; Herr and Buchler, 2010; Kestwal *et al*., 2011). MUFA imposes good effects on human blood lipid and glucose. It could reduce the risk of cardiovascular disease (Kris-Etherton, 1999; Galassetti and Pontello, 2006).

To promote good health and control disease, intake of omega–3 is highly recommended (Whelan and Rust, 2006). There are several benefits of conjugated omega–6 that help to reduce body fat along with antidiabetogenic and immune–modulating properties (Rainer and Heiss, 2004). It is clear that has besides a lot of qualities, rapeseed oil has its antioxidant and bad cholesterol-reducing activities (Papazzo *et al*., 2011). In comparison to tthe bad effects of its oil on health are least supported due to less research, still its good effects are convincing.

Uses of rapeseed oil

Rapeseed is mainly used for eidble and non-edible purpose. It is also used in cooking for frying, salads and dressing and in the formulation of shortenings. The choice of vegetable oil for these common usages depends on the flavor, nutritional value, texture, stability, cost, and availability, while avoiding transfats as possible (Čmolík *et al*., 2008). the oil, extracted through cold-pressing and filtration is termed as “virgin oil” that is often seen in the market. In terms of nutritional value and economical asset, virgin oil is qualified as the best. The quality of frying oils mainly depends on the amount of saturated and transfats and oxidative stability. As compared to sunflower and palm oils, rapeseed “high oleic acid and low linolenic acid” (HOLL) oil has a better frying performance (Przybylski and Eskin, 2011). It contains ~78% of oleic acid, ~12% of linoleic acid, and ~3% of alpha–linolenic acid. This oil is more refined with a light flavor and a smooth texture. Due to its high stability along with oxidation-resistance, it is suitable for deep-frying, recycling, and long-term storage. It is reuseable as far as 10 days due to less acrylamide, less oxidization, and presence of toxic compounds (Čmolík *et al*., 2008). Physicochemical properties could be improved by blending it with other oils. It was reported that an 80:20 blend of rapeseed and olive oil, added with 20% of palm oil was a better oil combination compared to a blend with a higher ratio of olive oil, and the fatty acid profile showed low free fatty acids and high oleic acid contents, but also a low peroxide level and a high iodine value (Roiaini, 2015), which might indicate deep-frying suitability and long-time storage. Rapeseed oil enhances the nutritional value while raw oils add an extra flavor and texture for salads and mayonnaise.

Inedible Oil

Besides eidible usage, rapeseed oils are mainly used for several purposes. For industrial applications, particularly high erucic acid rapeseed (HEAR) oil is used. This type of oil help to fight for diseases and stresses and also it increases the oil yield (Zelmer *et al*., 2009). Erucic acid is mainly used to improve hair substantivity. It is an excellent source for cosmetics fabrication, while omega-9 used to soften and protection of hairs from dryness and omega-6 used to increase and maintain the hair growth and a healthy scalp.

Besides all industrial uses, rapeseed oil was also developed for pesticide that is used to get rid of insects by irrigation, mainly loopers, aphids, worms, caterpillars, and mites. Due to itsrapid decomposition and low toxicity, it has no harmful effects on humans and the environment. Its cold point and pour point was observed near about (0 °C) and pour point (−15 °C) respectievely that is much lower than that of other feedstock (Peterson *et al*., 1997). This specificity of rapeseed oil made it more suitable for biodiesel usage. Its biodiesel is more suitable for cold climates due to delayed crystal formation properies. It also used to maintain a fluid property even at low temperatures. Its oil has a lower iodine value (less oxidation) and higher oil content in comparison to other vegetables; for instance, 127–160 and 48 gallons per acre were obtained in rapeseed and soybean, respectively, along with 114 and 130 of iodine value, respectively.

Protein Meal

The residual or left over product from seed oil extraction is known as meal that could vary from 35 to 40% due to the growth conditions, harvest, and processing. The fatty acid profile including oil and carbohydrates contents could also vary in rapeseed meals. There with a ratio must be ~1–3.5% and ~23%, respectively depending upon the processing (Arntfield and Hickling, 2011). Its amino acid profile has been revealed to be more suitable for animal feeding as having less lysine and high methionine and cysteine.

Eidible Food Utilization

The amino acid profiles of rapeseed proteins are found to be good and balanced (Pastuszewska *et al*., 2000). Due to its nutritional value and functionality, rapeseed meal has been qualified as a good protein source for human consumption (Aider and Barbana, 2011). in comparison to rice and wheat, rapeseed is reported to have three to four times higher proteins (Fu, 2007). Alsoin comparison with soybean it had better emulsifying and foaming characteristics (Khattab and Arntfield, 2009). Moreover, to produce enzymes, its meal could be used as a substrate for fungi. Based on rapeseed, some powder proteins supplements have been developed, like SuperteinTM and Puratein of Burcon Nutrascience (Schweizer *et al*., 2007). These isolates were reported to have better physical, organoleptic and functional characteristics than the isolates of conventional extraction. The production of these isolates did not require harsh chemicals.

Animal Fodder

The protein meal of rapeseed is the chief source of feed for poultry, ruminants and fish. Its incorporation into animal diets consequently has an impact on palatability and feed intake, body performance, and the production of milk, meat, or eggs, implies a balance in protein ratio. As a source of protein supplements, it could increase the weight in cattle (Petit and Veira, 1994). It was also reported as barley substitute (up to 15%), as demonstrated (Damiran and McKinnon, 2018). In cattles, supplemented with rapeseed meal (compared to those fed with soybean meal), the milk yield was significantly increased (Huhtanen *et al.*, 2011), and in a combination of rapeseed meal with wheat distillers' dried grains with soluble (Chibisa *et al.*, 2013), or as a substitution for wheat.

Protein for Bioplastic Based Materials and Cosmetics Fabrication

The use of rapeseed meal in the non–edible sector has been studied and exploited. The meal also contain some anti-nutritional compounds that in meals. In context of usage, bioplastic-based materials and cosmetics has emerged in recent years. The rapeseed protein was used as a capsule for bioactive drugs delivery (Bandara *et al*., 2018). While blended with resins and nanomaterials, it could be used as an adhesive but also as plastic films for packaging. On protein precipitation and aqueous extraction, fabrication of polymer films has also been reported (Zhang *et al*., 2018).

Brassica mainly rich source of Vitamin B9 (folate), that is highly required to produce new cells and to prevent birth defects, particularly in the brain and the spine during pregnancy (Naderi and House, 2018). While combined with cholesterol and cholate additionally, rapeseed contains Fe, carotene, and dietary fiber that ultimately lower the absorption of lipid

(Zhang *et al*., 2010). It also contain phytates and tocopherols (vitamin E) that are antioxidants (Khattab *et al*., 2010), and phytosterols could decrease the low-density lipoprotein (LDL) cholesterols (Venkatramesh *et al*., 2003). among main antiquality components, glucosinolates are active compounds . These are found in cruciferous vegetables. It has been confirmed that anti-cancer properties of glucosinolates could greatly prevent cancer by eating cruciferous vegetables (Verhoeven *et al*., 1997). These anti quality components are only harmful when they are processed for animal feed, because an enzyme (myrosinase) released the toxic products during the treatment (Mawson *et al.*, 1993; Yu *et al.*, 2010). By ablating myrosin cells, that mainly contain myrosinase, it could be removed without affecting plant bioactive (Borgen *et al*., 2010). Mammals could not directly assimmilate the dietary glucosinolates (including humans). It could be hydrolyzed into isothiocyanates and other cyanates (Holst and Williamson, 2004). They are one of the best substances in vegetables that induce apoptosis due to strong anti-cancer ability (Wu *et al*., 2009; Kalpana Deepa Priya *et al*., 2013. Isocyanates' ability to inhibit and fight against cancer was reported in several studies.

CONCLUSION

It was concluded that the oilseed crop is very important for nutrition, edible oil, market and industry. Brassica species using oilseeds increased are during last 42 years and important as a vegetable oil in the world after cotton. *Brassica rapa* has rich diversity in the world including different sub-species. Its different plant parts show strong anticancer and antioxidant activities. The root and leaf parts of different vegetables sub-species are predominantly used against different types of cancer cell lines and showed strong inhibitory activities against cancer.

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Cite This Article: Sana-e-Mustafa & Humera Razzaq (2022). An Overview; Unleashing the Health-Beneficial Progress of Turnip *(Brassica rapa). EAS J Biotechnol Genet, 4*(3), 36-40.