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Aphrodisiacs: A short review on naturally available sexual boosters

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Abstract

Aphrodisiac medication products are those that, according to the Food and Drug Administration, "carry labelling claims that they will excite or enhance sexual desire or that they will improve sexual performance." This article's goal was to review the most widely used herbs, fruits, and vegetables that are aphrodisiacs, as well as their pharmacological research, mechanism of action and phytoconstituents. Products were rated according to the calibre of the study, as well as their safety and efficacy records. Based on earlier research investigations, products with minimal risk and possible benefit for sexual response were highlighted. Yohimbine, spanish fly, mad honey, and bufo toad should all be avoided because research has shown that they may have more hazards than benefits. Other products, such ginseng, maca, tribulus, and ginkgo, have scant but growing data. Future studies and additional clinical trial data should be conducted to clarify the effectiveness and safety of these products. Before healthcare professionals can suggest the majority of aphrodisiac products, further randomised scientific research on safety, effectiveness, and dosage are required. Medical issues with medication interactions, purity, dependability, and safety still exist.

1. Introduction

For centuries, man has been searching for the secret to sex pleasure. Almost nature provides plant, fruits as being helpful for sexual vigour, augmentation. In the era, medications like PDE-5 inhibitors (Corona *et al*., 2018), testosterone tablets, and implantable pellets are created to treat similar sexual disorders. Additionally, patients commonly look for natural aphrodisiacs since they are safer options (Bharathi *et al*., 2021). This article will go over some naturally occurring aphrodisiac products that are derived from both plants (Rowland *et al*., 2003) and animals. Through, hallucinogenic effects or other mood-stimulating qualities, aphrodisiacs can have psychological effects that increase sexual desire and pleasure, increase blood circulation, and relaxing smooth muscle (Shamloul *et al*., 2010).

2. Exploring animal-based aphrodisiacs: Unveiling their myths and reality

2.1 Honey

The custom of newlyweds sipping mead, a beverage made from fermented honey, until the first new moon of their marriage, is thought to have given rise to the word “honeymoon”. Popular aphrodisiac honey has been used for millennia to add passion to unions. Mad honey, which includes grayanotoxin, is prepared from *Rhododendron ponticum* nectar. Continuous vagal stimulation results from grayanotoxin’s binding and activation of brain sodium ion channels. Grayanotoxin causes bradycardia and hypotension at low dosages, whereas syncope, atrioventricular block, and asystole occur at large levels (Jansen *et al*., 2012; Yarlioglues *et al*., 2011). Mad honey is a poison that should be avoided since it might be fatal.

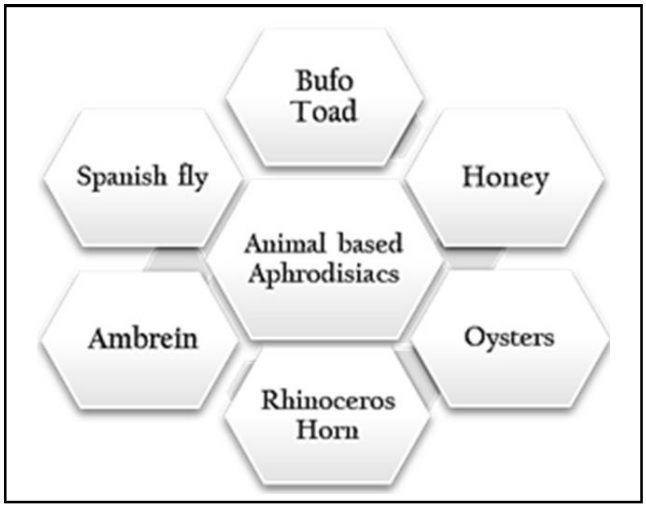

Figure 1: Animal based aphrodisiacs.

2.2 Bufo toad

Toads of the Bufo genus are widespread around the world, and their skin and gland secretions contain bufotenin, a psychoactive toxin with serotonin-like properties that has historically been utilised for therapeutic and aphrodisiac purposes (Shamloul *et al*., 2010). The venom has long been employed as a psychedelic, a street drug, and in the traditional Chinese aphrodisiac Chan su as well as the West Indian aphrodisiac love stone. However, bufotenine and its O-methylated derivative 5-methoxy-M, N-dimethyltryptamine found in Bufo toad may be responsible for its aphrodisiac effects. There is no evidence linking Chan su and Bufo toad secretions’ detrimental effects on heart rate and cardiomyocyte contractility to either

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improved or worsened sexual performance. The FDA has outlawed the intake of Bufo toad due to its potential for lethality after several recorded incidences of poisoning and at least one fatality following ingestion (Jansen *et al*., 2012).

2.3 Spanish fly

The most well-known blister beetle species is *Lytta vesicatoria*, which has a reputation for boosting sex. As a defensive mechanism, it secretes a poison called cantharidin. Cantharidin is harmful to humans at large amounts, yet despite the danger, it has long been used to improve sexual performance. Spanish flies activate beta receptors while inhibiting phosphodiesterase (Hutchings *et al*., 2018) and protein phosphatase. The end outcome is urogenital tract inflammation and vascular congestion of the sex organs. The toxin, however, can cause mouth and throat burns, genitourinary infections, hematuria, and urethral scarring. Additionally, excessive intake results in renal failure, gastrointestinal bleeding, and death. The numerous fatalities linked to cantharidin use indicate that it should not be used to increase sexual performance. According to the study by Leavitt cited above, rats died at a high cantharidin dose of 2 mg/kg, while people have been known to die at doses as little as 10 mg (Sandroni *et al*., 2001; Tagwireyi *et al*., 2000; Karras *et al*., 1996).

2.4 Oysters

Many varieties of seafood are considered to have mythical aphrodisiac qualities since the goddess Aphrodite was said to have been born from the sea. He ate 50 oysters a day to increase his sexual vigour and endurance. For the spermatogenesis process and the creation of testosterone, oysters provide vital nutrients. Additionally, serotonin and certain amino acids that are essential to the neuronal circuitry of the pleasure response are considered to be present in oysters.

2.5 Rhinoceros horn

Because of the fabled horn, hunters have pushed rhinoceros to the verge of extinction. A rhinoceros horn may sell for huge dollars due to its high demand. Calcium and phosphorus can be found in the horn. The horn's widespread reputation as an aphrodisiac stem from the fact that it resembles the penis in form. For its purported medicinal and sexual benefits, the horn has been crushed into a fine powder. Therefore, there is no part of the horn that has any intrinsic aphrodisiac properties, and there is no evidence to suggest that its usage is beneficial (Langfitt *et al*., 2013).

2.6 Ambrein

A significant component of Ambergris, generated in the sperm whale's digestive system, is *Physeter catodon*-Whale Ambrein. Due to its purported anti-inflammatory and antinociceptive characteristics, ambergris has been used to treat headaches, rheumatism, common colds, and constipation. Recent research has shown its efficacy as a natural aphrodisiac, and it has also been used to improve sexual performance. Vasoconstrictor hormone effects on various animal smooth muscles can be lessened by isolated ambrein. Ambrein's capacity to diminish muscular spasms suggests that the aphrodisiac may be able to assist erection owing to enhanced blood flow. In the studies by (Taha *et al*., 1995) and colleagues, 100 and 300 mg/kg body weight of ambrein enhanced the number of penile erections in rats as well as intromissions and anogenital exploratory activity when females were present. Based on the findings, the scientists came to the conclusion that ambrein, an efficient aphrodisiac, modifies sexual behaviour in rats (Taha *et al*., 1995).

3. Characteristics of aphrodisiac

A perfect aphrodisiac should intensify and maintain sexual satisfaction throughout the cycle. Increase desire, increase stamina, and thrill are other properties. We cover mate-related parameters such as mount frequency, mount latency, intromission frequency, intromission latency, post-ejaculatory interval, copulatory rate, index of libido, and calculated male sexual behaviour (Figure 2). Additionally, the plants, edible fruits and vegatable and its phytoconstituents responsible for the study's mode of action is discussed below in (Tables 1-3).

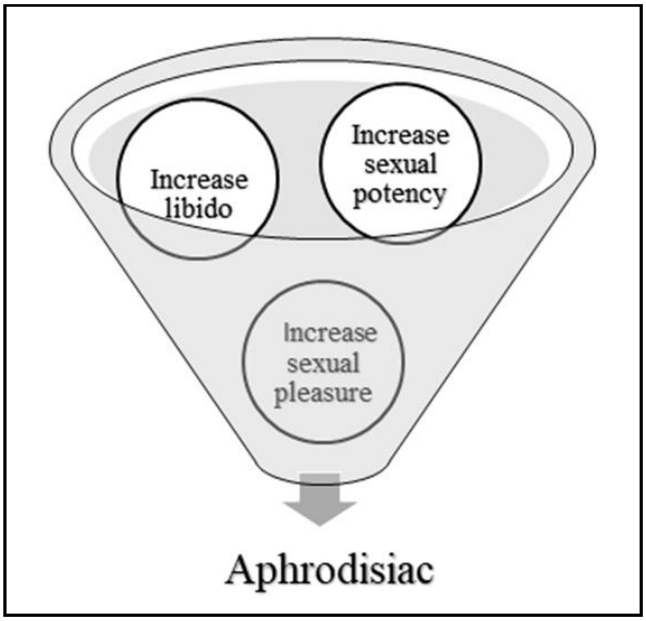

Figure 2: An ideal aphrodisiac.

Table 1: Plant derived sexual boosters

Biological name and common name	Mechanism of action	Pharmacological study	Phytoconstituents	References
Aloe barbadensis (Aloe vera)	Vitamin E prevents the loss of leydig and sertoli cells and increases their numbers, which raises testosterone levels, enhances testis weight, and strengthens the seminiferous tubule.	Different root extract concentrations, such as 100 mg/kg, 200 mg/kg, and 400 mg/kg, are given. The findings revealed that the testosterone concentration had increased at a dosage of 100 mg/kg and that the MF and IF had increased on days 1 and 14.	B-Sitosterol, barbaloin, mannose-6- phosphate, aloesin polysaccharide, aloe-emodin, emodin, vitamins.	Estakhr *et al*., 2011; Erhabor *et al*., 2017; Singh *et al*., 2018

Alpinia galanga (Blue ginger)	-	At 300 mg/kg per day, A's methanolic extract galangal increased the levels of serum testosterone.	Coumarin, terpenoids, flavonoids, volatile oils, and phenols.	Vijayalakshmi *et al*., 2022
Butea frondosa (Flame of the forest)	Relationship between brain dopamine, 5HT and sexual behavior. Both dopamine and 5HT are implicated in depression. Stimulants and antidepressants are known to effect libido, erection, ejaculation and orgasm.	For 28 days, the extract (400 mg/kg body weight/day) was given orally by gavage. Sexual behaviour was observed on days 0, 7, 10, 14, 21, and 28 of the research. ML, IL, EL, and PEI were all dramatically decreased by the extract. Additionally, the extract dramatically raised MF, IF, and EF in both sexually active and inactive male rats.	Amino acids, alkaloids, and fixed oils.	Ramachandran *et al*., 2004; Bhuvaneswari *et al*., 2021
Zea mays (Purple corn)	Nitric oxide influences male sexual behaviour in rats by elevating sexual performance indices.	The aqueous extract was administered orally at doses of 25, 50, and 75 mg/kg. Results revealed that the intromission and ejaculation lag times were decreased. All test dosages given to male rats through single IV injection appeared to trigger the genital motor pattern of ejaculation.	Tannins, saponins, alkaloids, flavonoids, steroids cardiac glycosides, phenols, terpenoids, glycosides.	Carro-Juárez *et al*., 2017; Brobbey *et al*., 2017; Benelli *et al*., 1995
Anacyclus pyrethrum (Arkakara)	Its vasorelaxant qualities, which might be brought on by a rise in NO.	Aqueous extracts at doses of 50 mg/kg and 100 mg/kg significantly increased anabolic and spermatogenic effects in albino rats.	Amides and volatile oils.	Sharma *et al*., 2013
Caesalpinia benthamiana (Bail)	Phenolic substances (gallic acid, resveratrol and tannins). Significant vaso relaxing characteristics were revealed by the findings.	Oral dose of aqueous extract, when given 50 mg/kg, MF and IF significantly increased, whilst methanolic extract demonstrated an accelerator effect by shortening the latent period.	Terpenes, benthamine, fatty acids, flavonoids, and alkaloids.	Zamblé *et al*., 2008
Cannabis sativa (Marijuana, Bhaang)	Modulates the right nucleus accumbens' sensitivity to visual sexual stimuli. The nucleus accumbens is associated in the processing of sexual behavior's satisfying benefits, and activating dopamine receptors in this brain area has been found to promote sexual drive even in sexually fulfilled animals.	Used to treat the illness in general and to treat impotence and increase libido.	Cannabinoids, phenol, alkaloid, flavonoid, and volatile oils.	Payne *et al*., 2019; Bhambhvani *et al*., 2020
Chlorophylum borivilianum (Safed musli)	Similar to testosterone, stigmasterol primarily contributes to its aphrodisiac properties.	Dried aqueous root extract of *C. Borivilianum* increased libido, sexual vigour, and sexual excitement in rats at a dose of 250 mg/kg.	Glycosides, saponins, fatty acids, and hydrocarbons.	Khanam *et al*., 2013
Eurycoma longifolia (Tongkat ali, Pasak bumi, Malaysian ginseng)	Enhances testosterone by preventing PDE inhibition and the aromatic conversion of testosterone to oestrogen. Male infertility is impacted by *E. longifolia* extracts by decreasing the production of the -2HS glycoprotein, which raises testosterone levels.	Rat spermatogenesis and testosterone steroidogenesis were both boosted by 25 mg/kg and it increases in free and total testosterone concentrations as well as muscular power were seen in both men and women after taking 400 mg/day for five weeks. Another study, male rats were given daily doses.	Phenols, quassinoids, alkaloids, volatile oils, and hydrocarbon.	Low *et al*., 2013; Ang *et al*., 2003

		of 3 ml/kg of normal saline during 12 weeks, whereas the control group got 0.5 g/kg of different *E. longifolia* fractions. Results revealed that it enhanced the sexual qualities of the middle-aged male rats.		
Myristica fragrans (Nutmeg)	Myristicin's stimulation of the neurological system.	50% ethanolic extract showed significant increase in mating frequency, libido and potency in mice.	Essential oils, fixed oils, unsaturated aliphatic hydrocarbon.	Latif *et al*., 2005
Ocimum gratissimum (Wild basil, Ocimum)	Angiotensin II levels in penile parts being reduced by ACE inhibitors, *O. gratissimum*, ability to reduce angiotensin-II levels, and inhibitors of the arginase enzyme may all be effective treatments for erectile dysfunction.	Significant increase was seen in MF, IF, penile erection after extracts were given orally to 6 groups of male rats once daily for 7 days at doses of 100, 250, and 500 mg/kg.	Volatile oils, alkaloids, and tannins, phenolic and flavonoid contents.	Ojo *et al*., 2019
Passiflora incarnata (Passion flower, Wild passion vine)	Alpha-naphthoflavone (7,8-benzoflavone), is a tri-substituted derivative which was well-known aromatase enzyme inhibitor has been postulated to be a neurosteroidal mechanism *via* which this extract potentiates blood testosterone levels in the body and prevents the metabolic breakdown of testosterone.	Mice have received the methanolic extract at doses, with 100 mg/kg having the maximum efficacy. The results indicated a strong aphrodisiac.	Phenolics, alkaloids and sugars.	Dhawan *et al*., 2003; Kotta *et al*., 2013
Coffea arabica (Peaberry, coffee)	Stimulant properties and potential to increase work and power.	Powdered pea coffee beans had showed almost similar effect of kissing vagina that of methyl testosterone and more effect that of regular coffee beans and the testosterone levels were average when compared to standard and normal coffee bean, when given to rats of musculus strain at a dose of 0.10/25 g.	Lipids, sugar, fatty acids, caffeine, and cysteine, betulin, phytol, citronellal, friedelin, crocetin, nicotine, hydroquinidine, quercetin, isoquercitrin, kaempferol, ferulic acid, scopoletin, xanthotoxin, wedelolactone, and saponins.	Abdulwahab *et al*., 2022; Wahono *et al*., 2016; Kotta *et al*., 2013
Camellia sinensis (Tea)	The central role of the serotonergic and dopaminergic systems in the ejaculatory action.	Effect of black tea brewon low dose, mid dose and high dose on wistar rats significantly prolonged the ejaculation latency and at low dose it increased testosterone levels in serum.	Alkaloids, volatile oils, polysaccharides, amino acids, lipids, vitamins, theophylline, theobromine, catechins, and flavonoids.	Ratnasooriya *et al*., 2008
Lepidium meyenii (Maca)	-	A clinical trial was done for 12 weeks by giving 1500 mg and 3000 mg of Maca gelatinizada and the hormones were tested again at 2-, 4-, 8- and 12-weeks interval and is has proven that there was no effect on sexual behaviour.	Glucosinolates, macamides, macaenes, thiohydantoins and alkaloids.	Gonzales *et al*., 2003; Dording *et al*., 2015; Huang *et al*., 2018; Gonzales *et al*., 2003
Crocus sativus (Saffron)	Enhances circulation speed. Other medications are more quickly able to reach the intended organs as a result of improved blood flow.	Safranal, crocin, and aqueous saffron extract (80, 160, 320 mg/kg body weight) and crocin (200, 400 mg/kg) enhanced MF, IF, and erection frequency in 66 male virgin wistar rats.	Carotenoid.	Butnariu *et al*., 2022

Serenoa repens (Saw palmetto)	The 5 alpha-reductase enzyme is thought to be inhibited, testo-sterone conversion to dih-ydro testosterone is prevented, and lower urinary tract smooth muscle is relaxed thanks to antagonistic muscarinic receptors.	-	Anthranilic acid, arachic acid, campesterol, capric acid, carotene, coumaric acid, daucosterol, farnesol, lupeol, myristic acid, quercitrin, rutin, sitosterol.	Ross *et al*., 2005
Pausinystalia yohimbe (Yohimbine)	Yohimbine increases cholinergic tone while decreasing adrenergic tone *via* antagonising the presynaptic alpha-2-adrenergic receptor and yohimbine is not advised due to its significant negative effects.	-	Yohimbine, alstyrine, tetrabyrine.	Van der Meulen *et al*., 1964; Ernst *et al*., 1998; Waynberg *et al*., 1994
Ptychopetalum olacoides (Muira puama)	Enhances the NO pathway, increasing penile erection.	A clinical study in showed that a man with low libido initially had a 60% rise in libido, while men with erectile dysfunction experienced a 50% improve-ment in erection.	N-trans-feruloyl-3,5-dihydroxyindolin-2-one, magnoflorine, menisperine, 4-coumaroylserotonin, moschamine, luteolin, caffeic acid, ferulic acid, 7-dimethoxy-luteolin, vanillic acid, ginsenoside, Syringic acid.	Tian *et al*., 2018
Fadogia agrestis (Black aphrodisiac)	ED-related core enzymes and the NO/cGMP pathway were repaired by antioxidant methods in the testicular and penile tissues of male rats.	Male albino rats were used to test the efficacy of aqueous extract of *F. agrestis* stem. The MF, IF, and EL were all consi-derably increased at all dosages, while the mount, IL, and time to peak were all significantly decreased. There was also a significant increase in serum testosterone.	Alkaloids, saponins anthraquinones and flavonoids.	Ogunro *et al*., 2023; Yakubu *et al*., 2005
Chione venosa (Naranjito)	-	The bark and roots include methanolic-aqueous extracts that enhance the plant's aphrodisiac properties.	Daucosterol, dider-roside, α-morroniside, β-sitosterol, sweroside.	Lendl *et al*., 2005
Montanoa tomentosa (Mexican zoapatle)	Oxepene sesquiterpenes function as an oxytocic agent to increase sexual potency, which is how they exhibit their aphrodisiac effects.	Copulatory activity was determined in male rats that were sexually active after receiving dosages of 38, 75, and 150 mg/kg of the aqueous crude extract of *M. tomentosa*. Additionally, the impact of a 75 mg/kg dosage of the extract on male rats who were not sexually active as well as on males with genital anaesthesia was assessed. It stimulates manly sexual activity in previously non-sexualized animals and serves as a strong activator of sexual behaviour and desire in male rats.	Sabinene, a-pinene and a-thujene, a-gurjunene, kaurenes caryophyllene and germacrene D.	Braca *et al*., 2001; Robles-Zepeda *et al*., 2006
Satureja khuzestanica (Savory)	Essential oil carvacrol and flavonoids increases concentr-ations of FSH and testosterone.	Male rats were given *S. khuzestanica* essential oil orally at dosages of 75, 150, and 225 mg/kg/day for 45 days in drinking water. All the	Carvacrol and flavonoids.	Haeri *et al*., 2006

		metrics, including potency, fecundity, fertility index, and litter size, dramatically improved. (150, 225 mg/kg). leydig cells and spermatozoids both increased in quantity.		
Eriosema kraussianum (Bangalala)	Pyrano-isoflavones, which were extracted from the roots of *E. kraussianum*, were effective in causing the smooth muscle in the penile muscle to relax.	Kraussianones were isolated from the root stock and tested for their ability to relax the smooth muscle in rabbit penile tissue. Kraussianone demonstrated action that was comparable to viagra's.	Eriosemaone, lupinifolin, kraussianone, quercetin, isoluteoin, kaempferol, astragalin.	Kleynhans *et al*., 2020; Awouafack *et al*., 2015; Drewes *et al*., 2002
Ruta chalepensis (Fringed rue)	Ruta chalepensis contains 3-phenylcoumarins, which have strong estrogenic properties.	In an experimental investigation, the plant's spermotrophic activity was seen as a rise in sperm motility, count, and encountered sperm defects.	Alkaloids, flavonoids, coumarins, tannins, volatile oil, sterols and triterpene.	Gijon *et al*., 1994
Mondia whitei (White's ginger, African ginger)	This plant elevates cGMP and NO levels in the carvemosal tissue, which is associated by a rise in NOS activity.	The relative weights of the caput epididymis, ventral prostate, and seminal vesicle increased significantly after administration of the *Mondia whitei* hexane extract at a dose of 1000 mg/kg.	Coumarinolignan, 5-chloropropacin, amyrine α-and β-sitosterol, lupeol, and glucoside, β-sitosterol, monoterpene lactone (-) loliolide.	Oketch-Rabah *et al*., 2012; Sewani-Rusike *et al*., 2015

Table 2: Exploring aphrodisiac properties in edible fruits

Biological name and common name	Mechanism of action	Pharmacological study	Phytoconstituents	References
Phoenix dactylifera (Dates)	It is possible that the PDE-5, ACE, alpha adrenoceptor, and arginase II inhibitory activities of phytochemicals such rutin and pelargonin play a role in the management of ED by phytonutrients in *P. dactylifera*.	Wistar albino rats were given doses of 35, 75, 105, 140, and 350 mg/kg of an aqueous extract of dates. In the extract-treated group, all behavioural patterns had improved, with the highest impact being shown at 140 mg/kg.	Rutin, luteolin, quercetin, catechin, cinnamic acids, cholesterol, stigmasterol, campestrol, β-sitosterol, anthocyanins.	Deshpande *et al*., 2017; Ehigiator *et al*., 2022
Anacardium occidentale (Cashew)	An increase in testosterone levels and the dopaminergic system, notably, as well as the inhibition of PDE-5 and corticosterone.	Oils from seeds and shells produced a considerable rise in sexual indexes and aphrodisiac activity, according to the data and leaf extract of *A. occidentale* leaf at doses of 25, 100, and 200 mg/kg BW exhibited sexual enhancing effect.	Carbohydrates, phenols, flavonoids, steroids, and proteins,	Wattanathorn *et al*., 2018
Punica granatum (Pomegranate)	Pomegranate fruit extract has aphrodisiac properties, which may be a result of its ingredients that stimulate the neurological system.	Wistar albino rats were given pomegranate fruit juice at doses of 500, 1000, and 1500 mg/kg daily once, and this caused the albino male rats to become more sexually active.	Flavonoids, pelargonidin, delphinidin, cyanidin catechin, epicatechin, quercetin, tannins ellagitannins, punicalagin, punicalin, pedunculagin, chlorogenic, caffeic, syringic, sinapic, p-coumaric, ferulic, ellagic, gallic and cinnamic acid.	Katana *et al*., 2019; Singh *et al.,* 2018; Lydia *et al*., 2019
Citrullus lanatus (Watermelon)	Citrulline enhances blood flow to the reproductive areas and is essential for blood relaxation, which is a key component of great sexual performance.	Different dosages of ethanolic watermelon extract, including 100 mg/kg, 500 mg/kg, and 1000 mg/kg, were given for 22 days. The findings demonstrated	Carotenoids.	Munglue *et al*., 2014

		that at the greatest dosage concentration, MF IF, and ejaculation latency all increased. At the lowest dose concentration, EL, IL, and ejaculation interval all increased.		
Musa acuminata Musa paradisiacal/ sapientum (Banana, Plantain)	Increase in blood circulation.	Aqueous banana peel extract to rats at the dose of 200 mg/kg and 400 mg/kg for 28 days, showed increase in ML, IF and ejaculation latency and it showed a decrease in MF, IF, ejaculation frequency and ejaculatory interval. The water extract of banana peel decreased testosterone levels and increased estrogen levels. On male rats, aqueous *M. paradisiaca* root extract at doses of 25, 50, and 100 mg/kg increased the testosterone levels.	Saponins, alkaloids, vitamins, glycosides, triterpenes, and sterols.	Zakaria *et al*., 2017
Fragaria ananassa (Strawberry)	-	A clinical trial was conducted for 40 females of a median age 21 and were distributed into two groups, one group of 19 was informed that strawberries are having aphrodisiac effect and the other group of 21 was told that it is an anti-aphrodisiac fruit.	Phytoestrogen, flavonoids, ascorbic acid, folate, ellagicacid, quercetin phenolics, anthocyanins, kaempferol, hydroxycinnamic acid, urate, tannins, catechins.	Ikram *et al*., 2019; McPhail *et al*., 2018
Artocarpus heterophyllus (Jackfruit)	-	Jackfruit seed suspensions was administered to Albino rats orally at 500 mg/kg and were observed 2-,6- hours after treatment. This study reveals showed positive impact on sexual function and fertility in male rats and it has proven that seed suspension causes sexual arousal, performance and vigour.	Artoheteroids A-D, morin, norartocarpetin, artocarpanone, artocarpesin, artocarpin, cycloartocarpin, carpesin, artocarpetin, brosimone-I, albanin-A cudralavone-B, carpachromene, steppogenin, cyanomaclurin.	Ratnasooriya *et al*., 2002; Sibi *et al*., 2021
Hylocereus undatus (Dragon fruit)	Most likely, phytosterol derivatives such -sitosterol, stigmasterol, and campesterol are what cause the white pitaya fruits' steroidogenic activity.	Ethanolic extract of dragon fruit were investigated on sprague-dawley rats at a dose of 500 mg/kg, found that total testosterone levels in serum have increased.	kaempferol, quercetin, isorhamnetin, glucopyranoside, isorhamnetin, galactopyranoside, rutin, β-sitosterol, stigmasterol, campesterol.	Yi *et al*., 2011; Kanedi *et al*., 2016
Cocos nucifera (Coconut)	-	Hydroalcoholic extract of *C. nucifera* was tested for infertility induced by cerric sulphate in male wistar rats. 400 mg/kg of extract which showed an increase in MF and IF. The testosterone levels in serum and cauda epididymal tissue were increased.	Leucoanthocyanidins, flavonoids, triterpenes, steroids, alkaloids, catechins, epicatechins, tannins, phenols.	Lima *et al*., 2015; Prakash *et al*., 2015
Panax ginseng (Ginseng berry)	Ginsenosides improve the transmural nerve stimulation -activated relaxation brought on by ach and increase NO release.	The sexual activity of normal male rats is greatly increased and maintained by panax extract. Improvement in erectile dysfunction and premature ejaculation, among other types of sexual dysfunction.	Saponins, flavonoids hydrocarbons and vitamins.	Leung *et al*., 2013; Jannini *et al*., 2005

Table 3: Exploring aphrodisiac properties in edible vegetables

Biological name and common name	Mechanism of action	Pharmacological study	Phytoconstituents	References
Cucurbita pepo (Pumpkin)	Reduced ADA, PDE-5', arginase activity and AChE, elevated NO levels, and decreased MDA levels in the rat corpus cavernosal tissues all contribute to penile erection.	Ethanolic extract of *Cucurbita pepo* seeds were tested in wistar albino rats at 200 mg/kg proved that ML and IL was less and MF, IF, ejaculation latency and copulatory efficiency was more.	Cucurbitacin, quercetin, p-coumaric, sinapic acid, vanillic acid, cardiac glycosides, resins, saponins, terpenoids, isorha-mnetin, D-glucopyranoside, quercetine. myricetine, glucopyranoside.	Adnan *et al*., 2017; Akomolafe *et al*., 2019; Sewani-Rusike *et al*., 2015
Moringa oleifera (Drumstick)	PDE-5 inhibition boosted testosterone levels as well as the quantity of spermatozoa and leydig interstitial cells.	1) Groups of rats containing healthy and diabetic induced male rats were administered with two different concentrations. Methanolic extract of *M.oleifera* seeds (45 mg/kg and 90 mg/kg) for 21 days. Results showed that increased active sexual behaviour in healthy animal and inactive in diabetic induced animal. 2) Effect of hydro-ethanolic extract of drumstick leaves at 10, 50 and 250 mg/kg for 7 days. PDE-5 activity on penis, serum corticosterone levels had increased on extract treated group at 10 mg/kg. 3) Aqueous extract of seeds of *M. oleifera* at doses 100, 200 and 500 mg/kg orally for 21 days. The extract then observed to increase sperm count and libido. 4) Water, ethanol and chloroform extract of *M. oleifera* seeds were treated to rats at 100, 200 and 500 mg/kg for 21 days and there was an increase in libido.	Glucomoringin, glucotropaeolin, rutinosides, glucosides, and malonyl glucosides, quercetin, folates, kaempferol, isorhamnetin.	Zade *et al*., 2013; Prabsattroo *et al*., 2015; Saini *et al*., 2016; Goswami *et al*., 2016
Allium cepa (Onion)	-	Two groups of male Albino rats, one with paroxetine-induced sexual dysfunction and sexually active rats-were inves-tigated for the effects of onion juice extract. Tests on paro-xetine-induced dysfunction revealed a shorter mount frequency period and higher testosterone levels.	Flavonoids, myricetin, kaempferol, quercetin, pigments such as or-ganonosulphur compounds, anthocyanins.	Bora *et al*., 2009; Allouh *et al*., 2014
Allium sativum (Garlic)	Nitric oxide (NO) synthase is how allicin improves blood flow to the sexual organs.	When mice were administered a 100 mg/kg aqueous extract of garlic bulbs daily for 3 months, the weight of their seminal vesicles & epididymides doubled. Ether extract of garlic (100 mg/kg) or (200 mg/kg) was given orally to male Wistar albino rats for 14 days which elevates the sperm count.	Peptides, steroids, terpenes, flavonoids, volatile oils and vitamins.	Al-Bekairi *et al*., 1990; Warange *et al*., 2019

Apium graveolens (Celery)	Apigenin increases leydig cells' susceptibility to cAMP stimulation, which promotes steroidogenesis, also an effective aromatase inhibitor.	Rats were given celery leaf water extract at concentrations of 100 mg/kg and 200 mg/kg for 30 days. The size of the seminiferous tubules, the volume of the testis, and the quantity of primary spermatocytes, spermatozoa, and spermatogonia all rose noticeably, whereas the quantity of spermatids increased at high dosages. Hydroalcoholic extract 14 days 400 mg/kg seeds increases the testosterone levels, testis weight, and total sperm count.	Steroids, glycosides, flavonoids, phytic acid, isoquercitrin, apigravrin, isopimpinellin, apiumoside, celerin, apiumetin, isoimperatorin, apigenin, celereoside and graveobioside.	Afzalzadeh *et al*., 2015; Kotta *et al*., 2013; Khalil *et al*., 2015; Kerishchi Khiabani *et al*., 2014; Hardani *et al*., 2015
Trigonellafoenum-graecum (Fenugreek)	Reduce the clinical symptoms of androgen deficit, enhance sexual performance, and boost testosterone.	Group of animals which contained 6 each had administered orally with plant extract as diabetic animals treated with standard drug (4 mg/kg), diabetic animals treated with *Trigonellafoenum-graecum* aqueous extract (0.87 g/kg and 1.74 g/kg) and were observed for 42 days. The results revealed that ML and IL had reduced and the mount frequency, IF and ejaculation frequency had increased.	Flavonoids, luteolin, apigenin, quercetin, orientin, isovitexin vitexin, saponins, trigonelline, galactomannans.	Gupta *et al*., 2015; Rao *et al*., 2016; Nathiya *et al*., 2014
Zingiber officinale (Ginger)	-	Grinded rhizomes of ginger dissolved in water was administered to rats at 5.6 mg/100 g dose for 42 days. After 2 weeks of extract administration there occurred a sperm cell degeneration.	Glycol monopalmitate, 2,3-dihydroxypropyl ester isovanillin, beta-sitosterol hexacosanoic acid, maleimide-5-oxime, 6-gingerol, p-hydroxy-benzaldehyde, adenine, 6-shogaol.	Duraisami *et al*., 2021; Bao *et al*., 2010
Mucuna pruriens (Velvet beans)	Providing a dose-dependent rise in FSH and LH, which as a result of L-DOPA and dopamine's effects, causes an increase in the manufacture of testosterone by the testis' leydig cells.	At 70 mg/kg, treatments significantly improved testosterone quality, psychological stress ameliorated and improved sperm count.	Alkaloids, amino acids, saponins, and vitamin.	Lampariello *et al*., 2012

5. Conclusion

Natural sexual enhancers have long been sought after in the search for increased desire and sexual stamina. As in the past, natural sexual enhancers are still widely used today. While recent research has somewhat clarified the products' mechanisms of action and ideal dose. According to studies, several items, including, spanish fly, yohimbine, bufo toad and mad honey should be avoided since they carry more hazards than benefits. Other aphrodisiacs, though, have preliminary but encouraging research behind them, including ginkgo, ginseng, maca, and tribulus. Before mainstream medical professionals can endorse any of these medicines, additional research is necessary to clarify the effects of other dosages, longer treatment times, and plant combinations.

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Conflicts of interest

The authors declare no conflicts of interest relevant to this article

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