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Mini Review on Chewing Gum for Oral Hygiene

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Abstract:

Objectives:
For maintaining oral hygiene, chewing gums have received more acceptability used as a cleansing agent over time. Fluoride for dental caries prevention, chlorhexidine as a local disinfectant, nicotine for smoking cessation, aspirin as an analgesic and caffeine as a stay alert preparation are now all included in oral hygiene chewing gum. Furthermore, a wide range of chewing gums for caries prevention, xerostomia relief, and vitamin/mineral supplementation are currently available. Oral hygiene chewing gum with specific qualities may now be developed and manufactured thanks to advances in technology and knowledge. The advantages, disadvantages, formulation, production process, and manufacturing process limitations are all nicely described in this review article.

Method:
The Oral hygiene chewing gum was prepared by direct compression method. Formulations were characterized for physical evaluation, weight variation, stickiness, hardness, and estimation of chewing gum consistency.

Conclusion:
Oral hygiene chewing gum is a cost-effective product and also shows a better cleansing property. It can administer anywhere, anytime, without water.

Keywords: Oral hygiene chewing gum, gum base, elastomer, direct compression method, plaque, caries, cavity, stability study.

INTRODUCTION:

It has long been known to like chewing on things besides food. Ancient Egyptians, Mayan Indians, and early American Indians all ingested tree resin. In 1848, the State of Maine Pure Spruce Gum became the first chewing gum to be offered for sale commercially. Dr. W.F. Semple, a dentist from Mount Vernon, Ohio, received the first chewing gum patent in 1869. On the sale of chewing gum globally, there are no trustworthy statistics. According to the information that is currently available, the global chewing gum market is estimated to be worth $5 billion yearly, or 560,000 tonnes. The average piece of chewing gum weighs 1.5 g, and 374 billion pieces are sold each year globally. In 1995, Switzerland sold 3,430 tonnes, or 490 grams, of chewing gum per person. This is small when you consider that each individual uses 2.5 kilograms in the US. Sales of chewing gum in the UK range from £80 to £100 million, with sugar-free gum accounting for a market share of 55%. Girls chew gum more frequently than boys in Switzerland, where 70% of customers are teenagers and 79 percent of chewing gums are sugar-free. There is no denying that chewing gum is a staple of candy and that it has an impact on dental health (Edgar and Geddes, 1990; Toors, 1992; ltthagarun and Wei, 1997; Edgar, 1998). In the past, chewing gum was often sweetened with sugar, which raised the risk of dental cavities. But today, sugar substitutes are used to sweeten more than half of the chewing gum market in Europe (polyols). Because the polyols do not induce a clinically significant synthesis of metabolic acids in dental plaque, clinical study suggests that sugar-free chewing gum does not cause caries. However, chewing gum increases saliva flow, which enhances saliva's defensive qualities such as buffering capacity, mineral supersaturation, and cleaning, antibacterial, and agglutinative effects. This proves conclusively that there are benefits to chewing sugar-free gum. Thanks to product claims about dental caries like "safe for teeth," "does not cause tooth decay," and "tooth-friendly," consumers have been able to distinguish between chewing gum that is sugar-free and gum that contains sugar for more than 20 years (under license from the "Toothfriendly Sweets International Association"). A number of manufacturers have recently made further market-driven and unverified health claims for chewing gum linked to caries in pamphlets, booklets, and TV commercials. The latter's clinical applicability and scientific foundation are still up for debate, and the dentistry profession does not always concur with such assertions. Regarding food health claims, each nation has its own rules that are frequently changed. Because of this, ideas that are outlawed outright in one country could be allowed or accepted in another—where no action is taken in response—while still being illegal in a third. Patients usually ask the dentist questions when they are unsure of who or what to believe in this circumstance. In order to effectively counsel patients who are perplexed by the most recent "commercial arms race," oral health care practitioners need to be able to distinguish between fact and fantasy." (1)

TYPES OF CHEWING GUM :(2)

1. Cut and wrap:

To endure the stretching that occurs in the c, the gum bases for this type of line must be rather flexible. To survive stretching that occurs in the cooling tunnel, the gum bases for this kind of line must be moderately flexible. Due to the larger piece size, the chewing gum formulation should be softer than traditional chewing gum. This is accomplished

by adding more liquids to the mixture (glucose and sweeteners).

Fig 1.1 Cut and wrap

2. Sticks and tabs:
For laminated items, the gum bases need to be both flexible enough to be molded by rollers and stiff enough to wrap well after curing. Typically, laminated gum has a lower gum base percentage than cut and wrap gum. In addition, the glucose content needs to be controlled to maintain the necessary elasticity to stop the pieces from breaking when bent while still providing the necessary hardness for the packaging process.

Fig 1.2 Sticks and tabs

3. Pellets/pillows:
Gum for chewing comes in stick-like pellet form. Gum bases for laminated items should be flexible enough to be molded by rollers and harden sufficiently to withstand cooling after curing.

Fig 1.3 Pellets/pillows

4. Hollow balls:
For gum bases to maintain their shape and avoid leaking, they need to have a certain level of plasticity and elasticity (less than goods that are cut and wrapped) (if filled). The center needs to be sturdy enough to withstand coating once it has dried.

Fig 1.4 Hollow balls

5. Liquid-filled gums:
The following qualities should be present in gum bases for stamped chewing gum: a) Enough elasticity to withstand stretching during equalizing stages.
b) Enough plasticity to easily take the shape that the shaping machine's dies produce.
The chewing gum's gum base percent range should enable the best formulation and seal. If the gum base content is either low or too high, the product will distort.

Fig 1.5 Liquid-filled gums

6. Gum-filled candy:
Lower viscosity gum bases could be trickier to work with because they might become liquid at the high temperature of the confection.

Fig 1.6 Gum-filled candy

7. Compressed chewing gum:
They are made of a compressible powder for the pharmaceutical and functional markets.

Fig 1.7 Compressed chewing gum

ORAL HYGIENE:
TOOTHPASTE:

Toothpaste is a paste or gel that is applied to the teeth with a toothbrush in order to maintain and improve oral hygiene and appearance. Paste compositions have seen significant evolution since their creation thousands of years ago, going from simple solutions of cracked egg shells or ashes to complicated mixes containing more than 20 elements. Among these could be medicines to treat gum disease, calculus, erosion, smell, and dentin hypersensitivity. Abrasives to clean and whiten teeth, flavors to freshen breath, and colors to improve visual appeal are all included in toothpaste. Effective toothpaste maximizes the bioavailability of the active ingredients. But when several different actives are created in a single phase, it might be difficult because compromises need to be made. One of the difficulties still facing toothpaste production is the bulk of active compounds' poor oral substantivity.

Toothpaste and toothpowder have been around for a while. The ancient Egyptians produced a dental cream that included pumice, myrrh, powdered oxen hoof ashes, and egg shells between 3,000 and 5,000 BC, mostly to clean teeth. Water was probably added only when it was needed. Around 1,000 BC, the Persians added charred oyster and snail shells, gypsum, herbs, and honey. A thousand years later, Greeks and Romans added more abrasives, such as broken oyster shells and bones, to the powder combination. It is believed that the Romans were the first to flavor paste, likely to aid in bad breath and to make it more appetizing. This flavor had a powdered texture. Today's charcoal flavors are distant cousins to bark. Around the same time, China and India both began using powder or paste. Given that they were flavored with ginseng, herbal mints, and salt, the toothpastes used by the Chinese, in particular, were extremely comparable to those used today. Due to their high levels of abrasiveness, disagreeable flavors, and excessive prices, ancient toothpastes were more expensive than modern toothpastes. Before the industrial era began in the 18th century and toothpowders became more common, not much changed. To particularly clean teeth, dental professionals, chemists, and other experts developed tooth powders. Since these powders comprised abrasives like brick dust, shattered china, earthenware, and cuttlefish, they were exceedingly harsh on teeth. The majority of toothpowders were created using bicarbonate of soda, which is still widely used today. Another sensory cue that has endured is the use of borax powder (sodium borate) at the end of the 18th century to produce a lovely foaming effect. To make the powders more appetizing and keep them from drying out in the early nineteenth century, glycerin was added to them. When strontium was first introduced, it was thought that it would strengthen teeth and lessen sensitivity. A dentist by the name of Peabody was the first to add "soap" (fatty acid salts like sodium palmitate) to toothpowder in 1824. In the 1850s, John Harris added chalk. In 1873, Colgate & Co. became the first company to mass-produce toothpaste in jars. Dr. Washington Sheffield of Connecticut was the first to use a collapsible tube to store toothpaste in 1892. One of the most significant discoveries in the history of toothpaste is fluoride, which was first made available in 1914. British Patent GB 3,034 defines "improvements in or relating to dentifrices" as including "formulas for sodium fluoride toothpaste" (filed in 1914; granted in 1915). However, it is unknown when the first fluoride toothpaste was actually sold. When Crest toothpaste was introduced by Procter & Gamble in the USA in test markets in 1955 and across the nation in 1956, it may have been the first fluoride toothpaste to be mass-marketed anywhere in the world. This statement was made after more than ten years of caries research, mostly because of a collaborative project led by Dr. Joseph Muhler of Indiana University. A brand-new toothpaste was developed with 1,000 ppm of fluoride in the form of stannous fluoride and heat-treated calcium phosphate as an abrasive. In a clinical investigation, it was discovered that this toothpaste significantly reduced the prevalence of caries in children. It was not; however, novel to use a fluoride toothpaste in a caries experiment. An earlier investigation by Bibby into the cariostatic effects of several toothpastes with sodium fluoride concentrations of 500 ppm fluoride in kids and teenagers came up empty. Given the ignorance surrounding fluoride's toxicity at the time, it is understandable why the American Dental Association (ADA) first opposed fluoride. Most people perceive new introductions with distrust. In 1960, the American Dental Association (ADA) allowed the addition of fluoride salts to toothpaste, paving the way for its widespread usage worldwide. In the past, just after World War II, as a result of the development of synthetic surfactants, sodium lauryl sulphate (SLS), which is still the most extensively used surfactant in toothpastes today, was first introduced. The question is, what happened to toothpastes during the previous century. Manufacturers have gradually altered formulations to improve fluoride absorption, reduce abrasion, improve stain removal, and encourage breath refreshing. Active chemicals have also been added to toothpastes in an effort to treat a number of oral diseases and ailments as well as provide cosmetic benefits. It is crucial to emphasize here that antiplaque and anti-tartar drugs, both of which were primarily introduced in the 1980s to prevent supragingival plaque formation. Other sources include a variety of other, frequently anecdotal references regarding allegedly medicinal toothpaste ingredients that have been tried and (for the most part) abandoned. It should be noted, nevertheless, that some toothpastes now still include enzymes. The claims that enzymes can aid in plaque removal, whitening, or gingival health are all supported by just weak scientific data. A toothpaste containing glucose oxidase and

amyloglucosidase has been successfully commercialized in Europe to boost the natural antibacterial activity of saliva and plaque fluid. Toothpaste development is still far from complete. The most difficult obstacle to overcome is the relatively low intraoral substantivity of active substances, especially fluoride.(3)

MOUTH WASH:

A liquid that can be gargled with the head leaned back and the liquid bubbling at the back of the mouth is known as mouthwash, mouth rinse, oral rinse, or mouth bath. It is a liquid that is passively maintained in the mouth or actively swished around the mouth through perioral muscular contraction and/or head movement.

Other uses for mouthwashes include analgesic, anti-inflammatory, and anti-fungal properties. To lessen the number of bacteria in the mouth, mouthwash is widely used as an antiseptic remedy. In cases of xerostomia, some rinses also replace saliva, neutralizing acid and preserving mouth moisture (dry mouth). Cosmetic mouthwashes briefly lessen or manage bad breath while leaving a pleasant flavor in the mouth.

After brushing with a fluoride-containing toothpaste, rinse with water or mouthwash to lessen the amount of fluoride that is present in the saliva. Fluoride's antibacterial and anti-cavity remineralization activities could be lessened as a result. Although it is more expensive than using fluoridated toothpaste to clean your teeth, fluoridated mouthwash may minimize this effect or enhance the amount of fluoride that is easily available. Despite the fact that it was explicitly advised in several public health advice publications to "spit, avoid rinsing with water/excessive rinsing with water," a group of specialists who examined post-brushing rinsing in 2012 found that they believed there was a poor evidence foundation for best practice.

DENTIFRICES:

Toothpowder and toothpaste are examples of dentifrices, which are cleansing and polishing agents used with a toothbrush. They come in paste, powder, gel, and liquid forms. Over the years, a variety of dentifrices have been created, some of which have been marketed using features like teeth whitening. However, to assist removal of food particles and dental plaque, dentists recommend toothpaste as the most crucial dentifrice to use alongside a toothbrush. Dentifrice is another name for toothpaste in French.

ORAL HYGIENE CHEWING GUM:

Dental Care A soft, cohesive substance known as chewing gum (OCG) is used to replace toothpaste and is chewed without swallowing. Oral hygiene chewing gum is made up of gum base, sweeteners, softeners/plasticizers, flavors, colors, and, frequently, abrasives, anti-caries, and anti-cavity compounds. Its elastic-plastic, sticky, chewy, and anti-cavity properties, as well as its anti-cavity properties and rubber-like texture, are a result of the physical-chemical properties of its polymer, plasticizer, and resin components.

Chewing gum is used for oral hygiene in place of dentifrices, mouthwash, and toothpaste. It is used in the mouth to prevent cavities and clean them. In the mouth, it acts as a cooling agent. It also cleans the teeth while giving off a pleasant mouth odor.

Why Use Chewing Gum as Toothpaste? (4)

Compared to traditional drug administration methods, chewing gum offers new competitive advantages:

- High acceptance by children,
- quick onset of action,
- high bioavailability,
- pleasant taste,
- higher compliance (easy, covert administration without water),
- readiness for usage

Advantages of oral hygiene chewing gum:(5)

1) Can be taken anyplace because swallowing does not require water.
2) Treats dry mouth and guards against caries and candidiasis.
3) Children find it very acceptable.
4) Gum never gets to the stomach. As a result, the effects of excipients on the gastrointestinal system are less severe.
5) Stomach does not come into direct contact with highly active substances, lowering the danger of gastric mucosa intolerance.
   The mouth's salivary flow is stimulated, and plaque acids that develop in the mouth after eating fermentable carbohydrates are neutralized.
8) Reduces and prevents stains, which helps whiten teeth.
9) Budget-friendly
10) It is applicable at all times.

Disadvantages of oral hygiene chewing gum:(6)

1) Children who chew gum for an extended period of time have ear pain and facial muscle pain.

2) Gum has been demonstrated to stick to enamel dentures and fillings to varying degrees.
3) Flavoring agents, cinnamon, and liquorice, which are found in gum, can induce mouth ulcers and hypertension.
4) Regularly eating sugary gums causes gum disease, tooth decay, and other oral health issues. When you chew gum, the sugar coats your teeth and progressively erodes the tooth enamel, especially if you don't brush them right away.
5) Chewing gum may trigger the release of mercury into your body if you have amalgam fillings, which include mercury as one of the constituents. Mental disorders, neurological issues, and other health problems may result from high mercury levels in the body.

EXCIPIENTS USED:(7)

1. Rubbers, both natural and synthetic Common elastomer solvents, may be included in the gum base composition to aid in the softening of the elastomer base component. Terpinene resins, such as alpha- or beta-pinene polymers, methyl, glycerol, or pentaerythritol esters of resins, as well as modified resins and gums like hydrogenated, dimerized, or polymerized resins or mixes, can be used as elastomer solvents. The elastomer solvents can be used in concentrations ranging from 5.0 percent to 75.0 percent by weight of the gum base, with a preference for 45.0 percent to 70.0 percent. Polyvinyl alcohol, synthetic elastomers like butadiene, styrene copolymers, polyisobutylene, and isobutylene isoprene copolymers are examples of bases. Non-toxic vinyl polymers like these are also used as bases. The vinyl polymer's molecular weight can range from 3,000 to 94,000. How much gum base is required depends on the type of base used, the desired gum consistency, and the other additives used in the final chewing gum product. Between 5 to 94% of the final chewing gum formulation's weight will be made up of the gum base. In the finished chewing gum composition, the gum base is commonly employed in amounts between 15% and 45 percent by weight and even more frequently between 15% and 35% by weight.

2. Plasticizers: Glycerides, waxes, and vegetable oils, such as lanolin, palmitic, oleic, and stearic acids, sodium and potassium stearates, propylene glycol monostearates, acetylated monoglycerides, glycerine, natural and synthetic waxes, hydrogenated vegetable oils, polyurethane waxes, and paraffin wax

3. Adjuvants: Talc and calcium carbonate are two other charging agents. Calcium carbonate, magnesium carbonate, aluminum hydroxide, aluminum silicate, talc, tricalcium phosphate, and dicalcium phosphate are examples of fillers and textural agents.4. Antioxidants: Antioxidants such as butylated hydroxytoluene, butylated hydroxyanisole, propyl gallate, and combinations of the same may be used.

5. Compression adjuvants: Silicon dioxide, magnesium stearate, calcium stearate, and talc are effective compressive adjuvants that can be utilized in chewing gum for oral hygiene. In chewing gum formulations with 2 to 8 percent moisture, alkaline earth metal phosphates and alkali metal phosphates avoid caking and balling during grinding. By absorbing moisture and permitting lubrication in the gum when it separates into granules, maltodextrin has also been found to improve chewing gum formulations with "high" moisture contents. If oil lubricants are employed, 0.4 to 1 percent by weight of the tableted chewing gum composition is desirable. Glidant can make up between 0.5 and 5 percent of the total composition of tableted chewing gum, depending on the composition's weight. Talc, starch, polyhydric alcohols, alkali metal salts, and combinations are a few of the glidants that have been found to be helpful. Chewing gum granules can block when they cling to one another, and anti-adherents stop this from happening. Additionally, they stop tablet granulations from sticking to die walls and punch faces. Silicates, silicon dioxide, talc, and mixtures of these are chosen as the anti-adhesives to be present in the composition of tableted chewing gum in amounts ranging from 0.2 percent to 1 percent by weight, with a preference for 0.3 to 0.6 percent by weight. The anti-adhesive is frequently a powder with a low bulk density that is finely divided but insoluble in water. Talc and fuzzed silica are the two most popular anti-adherents—micron-sized, pyrogenic, and hydrated silica. Talc and fumed silica are the anti-adherents that are most frequently utilized. Hydrated silica, micron-sized silicas, and pyrogenic silicas are all included under the umbrella term "fumed silica."

6. Sweeteners

a) Water-soluble sweeteners such as xylose, ribulose, glucose, mannose, galactose, galactose, fructose, fructose, sucrose, maltose, and partly hydrolyzed invert sugar starch, as well as sugar alcohols like sorbitol, mannitol, and hydrogenated starch hydrolysates.

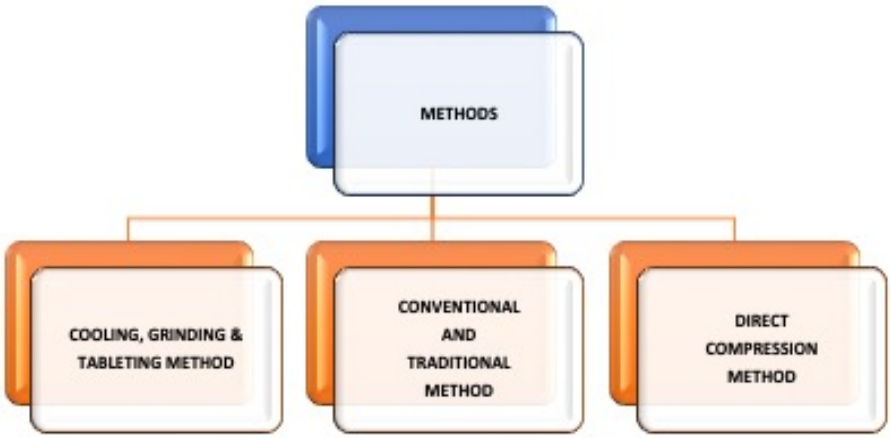
b) Water-soluble artificial sweeteners, like soluble cyclamate salts or sodium or calcium saccharin salts.

c) Dipeptide-based sweeteners: These include Aspartame, Alitame, methyl esters of L-aspartyl-L phyenylglycerine and L-aspartyl-L 2,5-dihydro-L phenylalanine, and L-aspartyl-L (1-cyclohexene) alanine, which are all generated from L-aspartic acid.

g) Protein-based sweeteners, such as thaumaoccous danielli, which are made of naturally occurring water-soluble sweeteners, chlorinated sugar compounds (sucrose, also known as Sucralose) (Thaumatin I and II). An appropriate amount of sweetener is often used to provide the desired level of sweetness; depending on the sweetener chosen, this amount can range from 0.0025 percent to 90 percent by weight of the gum composition.

7. Coloring Agents: Titanium dioxide and pigments may both be included in amounts up to about 2% of the gum composition's weight. Pigments may be added in amounts up to about 6%. The use of natural food dyes and colors for food, medicine, and cosmetics is also permitted.

8. Flavoring Agents: Wintergreen oil, anise oil, clove oil, citrus oils, fruit essences, peppermint oil, spearmint oil, and other essential oils and synthetic flavors are suitable flavoring agents.



METHOD OF PREPARATION:

The figure above shows the various chewing gum preparation techniques. Because it is less expensive and takes less time than the other two processes, the direct compression method was clearly the best choice for making chewing gum. OCGs were produced using direct compression molds. This method involved carefully and separately weighing each ingredient. Clove oil, PVP, beeswax, dextrose, calcium carbonate, peppermint oil, and ascorbic acid were all thoroughly mixed in a mortar in descending order of their weights. After thoroughly mixing the ingredients, a predetermined amount of PEG-400 was added before the mixture was evenly mashed in a mortar and pestle. With the aid of a mortar and pestle, the entire mixture was then once more thoroughly mixed. To create the chewing gum for oral hygiene, the material was combined and pulverized before being crushed into the appropriate molds. After being taken out of the mold, the specially formulated chewing gums were accurately weighed and packaged. Various batches of OCGs can be optimized by adjusting the concentration of various excipients.

PROBLEMS ASSOCIATED WITH THE ABOVE METHODS:(8)

1. Many pharmaceutically active substances have a bad taste or smell, which makes chewing gum products unappealing. The presence of many active substances in chewing gum is inappropriate since many of them irritate the mucosa and just a few others degrade quickly.
2. The fact that the gum base is heated to a fluid mass in order to facilitate the mixing of other ingredients is another problem with the methods mentioned above. At such high temperatures, heat-sensitive compounds, such as active ingredients and flavors, can deteriorate.
3. In addition, organic solvents are typically utilized to dissolve the active chemicals in medicinal gum formulations; these organic solvents are challenging to remove from the finished product, and even trace amounts of them can be harmful to human health.
4. In addition, the controversy surrounding the use of organic solvents in industrial processes is growing as a result of environmental and health concerns (e.g., risks attendant to exposure of personnel and problems in effecting proper disposal of waste solvents)
5. Water can also be used in gum preparations, but it can be difficult to do so, especially at the low temperatures required to manufacture chewing gum. The gum mass should not be heated in order to remove the water because the gum will become more sticky, making handling more difficult and impeding large-scale, semi-automated, or fully automated production. Due to their high moisture content, traditional chewing gum compositions are difficult to convert into chewing gum tablets. Water typically makes up 2 to 8% of the weight of traditional chewing gum compositions.

PHYSICAL EVALUATION OF GUM BASE:(9)

1. Color:
   The basis of the synthetic gum is a light yellow color.
2. Softening point:
   The softening point of the synthetic gum basis was discovered by heating it in a Petri dish. The temperature at which the base starts to melt is known as its softening point. It was found to range from 55 to 600 °C.
3. Solubility studies of synthetic gum base:
   It was discovered that the synthetic gum base obtained was the best for use as a base for chewing gum manufacture because the gum had such a low solubility in artificial saliva and phosphate buffer.

PHYSICAL EVALUATION OF ORAL HYGIENE CHEWING GUM:(10)

PHYSICAL EVALUATION OF GUM BASE:

Physical characteristics such as shape, thickness, color, and odor must all be evaluated. It is essential to physically investigate the OCGs because they are necessary for both marketing and individual acceptability; they serve a significant purpose and shouldn't be disregarded.

Weight variation:

On an analytical scale, each batch of chewing gum was separately weighed, and the average weight and standard deviation were found to be in acceptable ranges.

Stickiness:(14)
Oral hygienic chewing gum was placed on a flat surface and struck for 10 minutes by a Teflon hammer that weighed 250 g. 30 minutes were spent hammering.

- ❖ THICKNESS
- ❖ NON-THICKNESS

Texture Analysis: (11)
The chewing hardness was assessed to verify its stiffness and capacity to preserve its shape during production, packaging, and shipment. The hardness test was carried out using a texture analyzer (TA. XT). Before starting the test technique, the gadget is calibrated for force and distance. A perforated plate and a 2 mm cylindrical probe were used in the test, which was conducted on a heavy-duty platform. The center of the platform received the developed chewing. When a 5 gm trigger force was obtained, a sudden increase in force was observed as the probe moved closer to the test sample. The probe was moved 3 mm into the chewing gum and then put back in its initial position.

S**tability Studies :** (12)
According to ICH requirements and with the necessary modifications, an expedited stability study for created OCG was conducted. The OCG was subjected to a range of temperature conditions for 45 days, including 4°C, 30°C, and 45°C. OCG should be examined for consistency, color, odor, and pharmacological content.

SUMMARY AND CONCLUSION:

Therefore, it can be said that the gum for dental hygiene was created effectively. It has better customer compliance and is more cost-effective. It is crucially used as a tooth cleaner and an anti-cavity agent. Chewing gum for dental health has become a mainstay, and the indication will be widely acknowledged in the future. In the future, chewing gum for oral hygiene may become more prevalent than other products for the oral cavity. Chewing gum for oral hygiene can be used whenever and without water. It is simple to administer anytime, anywhere, and its tasty formulation increases client compliance.

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