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HOW CHEWING PATTERN PARAMETERS AFFECT NUTRITIONAL DISORDER: A LITERATURE REVIEW

Bagaimana Parameter Pola Mengunyah Memengaruhi Gangguan Gizi: Tinjauan Literatur

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ABSTRAK

Status gizi dipengaruhi oleh berbagai faktor, salah satunya adalah pola makan yang mencerminkan kebiasaan mengunyah. Ketidakseimbangan asupan dan gangguan pada proses mengunyah dapat berdampak pada penyerapan nutrisi dan status gizi. Penelitian ini merupakan kajian literatur yang bertujuan untuk mengidentifikasi pola mengunyah yang memengaruhi status gizi. Pencarian artikel dilakukan secara sistematis melalui basis data PubMed, ProQuest Central, Google Scholar, Cochrane, dan Sciencedirect menggunakan metode PICO. Artikel yang dianalisis dipublikasikan antara Januari 2014 hingga Desember 2024. 15 artikel memenuhi kriteria inklusi dari 1275 artikel yang ditemukan dan dianalisis lebih lanjut. Hasil telaah menunjukkan bahwa pola mengunyah berpengaruh terhadap status gizi melalui kuantitas dan kualitas pengunyahan, frekuensi makan, serta keterpaparan terhadap risiko penyakit mulut. Faktor-faktor ini lebih dominan ditemukan di wilayah Asia Selatan dan Tenggara, dibandingkan Eropa. Kebiasaan mengunyah yang baik berperan dalam meningkatkan asupan nutrisi, terutama pada kelompok rentan. Diperlukan intervensi berbasis kebiasaan makan dengan indikator mengunyah sehat untuk mendukung perbaikan status gizi.

Kata kunci: *literatur, mengunyah, nutrisi, parameter*

ABSTRACT

Nutritional status is influenced by various factors, one of which is dietary patterns that reflect chewing habits. An imbalance in intake and disruptions in the chewing process can affect nutrient absorption and nutritional status. This research is a literature review aimed at identifying chewing patterns that influence nutritional status. Article searches were conducted systematically using the PICO method across databases, including PubMed, ProQuest Central, Google Scholar, Cochrane, and ScienceDirect. The analysed articles were published between January 2014 and December 2024. Out of 1,275 identified articles, 15 met the inclusion criteria and were further analysed. The review findings indicate that chewing patterns affect nutritional status through chewing quantity and quality, meal frequency, and exposure to oral disease risks. These factors were more predominant in South and Southeast Asian regions compared to Europe. Good chewing habits play a role in enhancing nutrient intake, particularly among vulnerable groups. Dietary habit-based interventions with healthy chewing indicators are needed to support improvements in nutritional status.

Keywords: chewing, literature, nutritional, parameters

INTRODUCTION

Nutritional health is an important factor that determines a person's quality of life, especially in the context of maintaining overall health [1]. Good nutritional status is greatly influenced by various factors, including a balanced diet and the way the body processes food. One aspect that is often overlooked but has a significant impact is the

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way food is chewed[2]. Although seemingly simple, chewing habits can affect the efficiency of digestion and absorption of nutrients in the body. Chewing is the first step in the digestive process, involving both physical and neurological mechanisms [3], [4].

Chewing is regulated by a central pattern generator in the brainstem that integrates voluntary and involuntary neural activities to coordinate rhythmic jaw movements. This process involves several cranial nerves, including the trigeminal, facial, glossopharyngeal, vagus, and hypoglossal nerves, which control mastication, salivation, and tongue and facial muscle coordination [5]. From an autonomic perspective, chewing is primarily influenced by the parasympathetic nervous system, which promotes salivation and steady mastication. In contrast, sympathetic activation during stress can disrupt chewing rhythm and reduce efficiency, potentially affecting digestion, appetite regulation, and nutrient absorption [6]. Reflex mechanisms such as the chewing and jaw-opening reflexes help regulate the speed and depth of chewing by responding automatically to food texture and oral stimulation. These reflexes enable unconscious adjustment of mastication patterns, which can influence digestive efficiency and nutrient absorption [3].

Chewing is closely connected to the swallowing reflex, as effective mastication forms a cohesive bolus suitable for safe swallowing. Inadequate or rushed chewing can impair this process, especially in older adults or those with swallowing disorders, increasing the risk of reduced intake, aspiration, and poor nutritional status. Although swallowing is vital to digestion, it is rarely measured in nutritional studies due to its complexity and the challenges of assessment outside clinical settings. In contrast, chewing is easier to observe and modify, making it a more practical target for interventions that aim to improve eating behavior, nutrient intake, and digestive efficiency [6].

Several previous studies have shown a link between the way we chew our food and various aspects of health, including a person's nutritional status. Suboptimal chewing habits, such as chewing quickly or not chewing thoroughly, can hinder nutrient absorption and cause digestive discomfort [7]. A systematic review study in 2023 showed that chewing food slowly can influence satiety hormones and suppress appetite [8]. Women with overweight problems may benefit from chewing food well, as this process stimulates hormones involved in appetite regulation [9]. Chewing food well also helps the stomach and intestines work. Well-chewed food can be well mixed with stomach acid and other digestive enzymes when it reaches the stomach, speeding up the digestion process and reducing the workload on the stomach. In addition, smaller food particles can easily move through the small intestine, facilitating more optimal nutrient absorption [4].

Not only does it impact digestion and weight loss, but chewing food slowly and calmly also helps us develop food awareness [10]. Emerging research is beginning to highlight the role chewing patterns play in maintaining oral health and influencing metabolic processes. Abnormal chewing patterns, which may stem from factors such as missing teeth, gum disease or even stress, can lead to inadequate chewing of food, affecting digestion and nutrient absorption [11]. Furthermore, the health consequences of poor chewing patterns can extend beyond the oral cavity, contributing to conditions such as obesity, gastrointestinal disorders, and potentially even cardiovascular disease [12], [13].

Research has shown that chewing speed and efficiency can alter hunger perception, affect overall food intake, and contribute to weight management challenges [14]. Furthermore, recent research reveals that chewing not only affects the physical breakdown of food but also the neural signals associated with satiety and hunger, but the rhythm and duration of chewing can influence how much we consume, thus playing a role in weight management and overall health [15]. In addition to its physiological implications, the art of chewing also includes cultural and social dimensions, reflecting various eating practices around the world. Changes in the texture of solid food due to

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chewing may influence the nutritional status of older adults by inducing food cravings and providing enjoyment through sensory perception of food [16].

Although many studies have explored the effects of chewing on appetite, body weight, and metabolism, significant gaps remain regarding how specific chewing parameters—such as duration, frequency, intensity, and food texture—systematically influence nutritional status across diverse populations. Existing research often examines these factors in isolation and tends to focus on limited groups, without considering variations in age, health conditions, or oral function. In addition, there is a lack of comprehensive synthesis linking chewing patterns to both undernutrition and obesity. To date, no review has explicitly mapped chewing pattern parameters and their relationship to nutritional status across different demographic and social contexts.

This study addresses these gaps through a systematic literature review that examines the association between chewing patterns and nutritional status in a holistic manner. By integrating evidence from multiple studies, this review provides a scientific basis for developing chewing-based dietary interventions. The findings are expected to support public health strategies that emphasize education on optimal chewing practices to promote better nutritional outcomes.

METHODS

Design

This study employed a systematic literature review using qualitative synthesis. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and rigour.

Subject

The population of interest included children, adolescents, and adults without known oral motor disorders or significant cognitive impairments, as identified in the reviewed literature.

Variables

The main variables reviewed were chewing pattern parameters (e.g., frequency, duration, bite force, number of chews, and food texture) as the independent variable, and nutritional status indicators (e.g., BMI, food intake, micronutrient status) as the dependent variable.

Instrument (Literature search strategy)

An electronic literature search was conducted across five databases: PubMed, ProQuest Central, Google Scholar, Cochrane Library, and ScienceDirect. The search covered publications from January 2014 to December 2024, focusing on studies published in English. The search terms were defined using the PICO framework, and Boolean operators were applied to refine results. The following combination of keywords and operators were used: (chewing OR mastication) AND (nutrition OR nutritional status) AND (adults OR children) AND (eating behaviour OR food intake). Additional filters were applied to include only peer-reviewed articles, full-text availability, and human studies.

Study Eligibility and Selection

The criteria for including studies, government websites, and nutrition textbooks in this literature review included: (1) the collection period of the source studies spanning from 2018 to 2024; (2) full-text articles available in English 3) related to chewing or chewing habits or behaviours and their impact on nutritional status. And the excluded criteria related to subjects with oral disorders/diseases

Initial screening of studies was completed by reviewing titles and abstracts to assess eligibility. Studies that did not fit the inclusion criteria at this point were excluded. Of the remaining studies, full-text articles were reviewed to determine inclusion. Finally, a manual review of the reference lists of included studies was conducted to ensure all appropriate studies were sourced.

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Data Extraction and Analysis

A literature synthesis was conducted to review the methodological characteristics, outcomes, and variables reported in the eligible studies. Data from selected studies were systematically organized, summarized, and analyzed to identify recurring themes and draw conclusive statements.The literature search was carried out across five major databases—PubMed, ProQuest Central, Google Scholar, Cochrane Library, and ScienceDirect—using the keywords: chewing, nutrition, health, adult, and children. The initial search identified 1,275 articles. After removing 25 duplicates, 1,250 articles were screened based on titles and abstracts, resulting in 302 articles for further assessment. Of these, 207 were excluded for not meeting the inclusion criteria. Full-text review was performed on 95 articles, and 15 studies that met all eligibility standards were included in the final analysis (Figure 1).

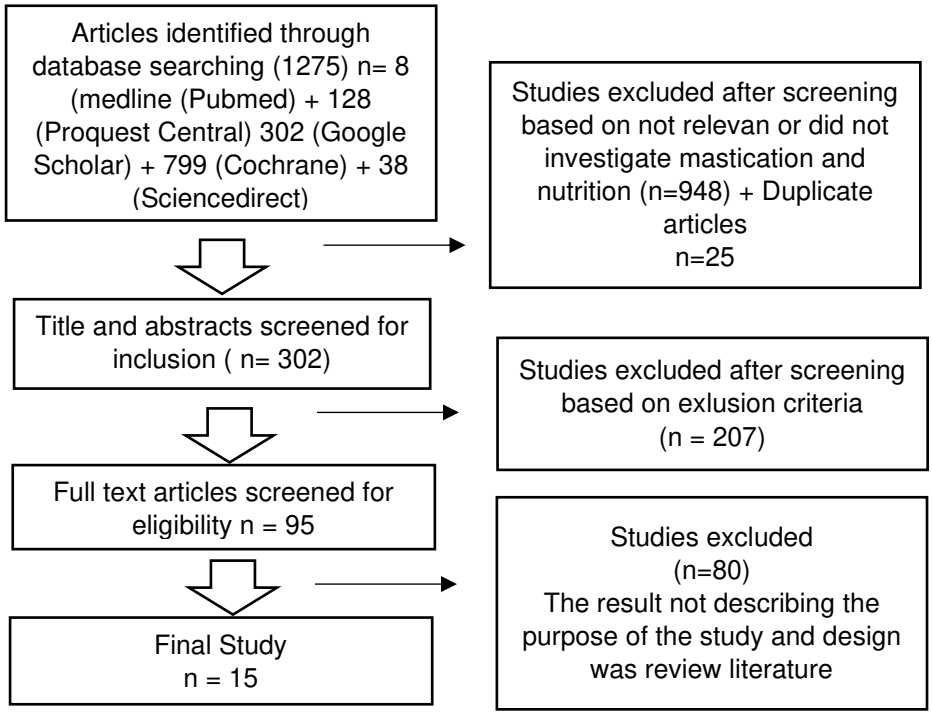

Figure 1. A Diagram showing the selection process for articles

RESULT

Table 1. Research Characteristic

No	Author(Year)	Key Variables	Design& Location	Participants	Key Findings
1	Ko et al. (2024)	Nutritional status, frailty, oral function	Cross-sectional; Taiwan	373 older adults	Swallowing dysfunction is associated with poor nutrition and high frailty.
2	Vucea, et al (2018)	Food texture; malnutrition	Cross-sectional; Canada	32 LTC homes	Minced and pureed food linked to malnutrition risk.
3	Kokura & Shimizu (2024)	Malnutrition; food texture	Retrospective Cross-sectional; Japan	98 older adults	Significant difference in BMI and muscle mass across IDDSI levels.
4	Chun et al (2022)	Cardiovascular disease; Chewing status	Cross-sectional; Korea	Adults and elderly	Chewing status modifies dietary quality and CVD risk.
5	Kim at al (2023)	Chewing Ability; Nutritional Status	Cross-sectional ; Korea	7835 elderly	Poor chewing linked to undernutrition and lower dietary intake.

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No	Author(Year)	Key Variables	Design& Location	Participants	Key Findings
6	Wu (2024)	Oral function; dietary intake; nutritional status	Cross-sectional: China	1003 older adults (75+ years)	Chewing/swallowing function affects nutritional status
7	Borvornparadorn et al (2019)	chewing; energy intake	Experiment; Thailand	45 Adults	Chewing 50 times per bite reduced calorie intake
8	Garcidueñas-Fimbres et al. (2023)	Eating Speed; Diet Quality; Adiposity, ; Cardiometabolic	Cross-sectional; Spain	1371 preschool children	Fast eating linked to adiposity and cardiometabolic risk
9	Mejean at al(2015)	Saliva production; taste preference; diet	Cohort; France	282 adults	Saliva affected by carbohydrate intake, not overall diet
10	Chairani et al (2023)	Masticatory;BMI	Cross-sectional; Indonesia	60 university students	Significant difference in masticatory score between BMI groups
11	Kudo et al (2019)	Fast eating; diabetes	Cohort; Japan	197,825 adults	Fast eating is a major predictor of new-onset diabetes
12	Iwasaki et al (2016)	Hyposalivation; dietary intake	Cross-sectional;Japan	352 older adults	Poorer dietary intake in individuals with hyposalivation
13	Fujimoto et al (2020)	Oral factors; BMI	Experimental; Japan	100 older Adults	BMI is associated with subjective chewing ability but not objective efficiency
14	Motokawa keiko et al (2021)	Chewing ability; Nutritional status	Cross-sectional; Japan	509 adults	Chewing ability is associated with nutrient intake and food quality
15	Okubo et al	Chewing; eating rate; weight status	Cross-sectional; Japan	4451 children aged 5–6 years	Chewing thoroughly more effective than slow eating for weight management.

Among the 15 articles analyzed, most originated from Japan, while the remaining studies were conducted in Taiwan, Korea, China, Indonesia, Spain, Thailand, Canada, and France. The majority of studies used cross-sectional designs, with a smaller number employing cohort or experimental approaches. Study populations ranged from children to older adults, although research was predominantly focused on the elderly (Table 1).

Across the selected studies, several chewing-related parameters were assessed, including mastication efficiency, food particle size and texture, salivary flow, and chewing rate or frequency. The reviewed evidence consistently demonstrated that impaired chewing ability was associated with poorer nutritional status. Specifically, chewing dysfunction was linked to increased prevalence of malnutrition, reduced dietary intake, and higher risks of metabolic and cardiovascular disorders. Collectively, these findings emphasize the essential mechanical and sensory functions of mastication in supporting adequate nutrition and overall health (Tables 1 and 2).

The data synthesis revealed three main themes regarding the relationship between chewing and nutritional status. First, chewing function was identified as a key determinant of nutritional adequacy. Several studies showed that reduced masticatory ability significantly increases the risk of malnutrition and inadequate nutrient intake, particularly among older adults, as reported by Ko et al. (2024), Kim et al. (2023), and Wu (2024).

Second, the interaction between food texture, salivary secretion, and nutrient absorption was highlighted. Findings from Vucea et al. (2018) and Kokura et al. (2024) indicated that soft-textured or pureed diets are associated with greater malnutrition risk, while decreased salivary flow negatively impacts appetite stimulation and digestive efficiency.

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The third theme emphasized chewing speed and its metabolic consequences. Evidence from Borvornparadorn et al. (2019), Garcidueñas-Fimbres et al. (2023), and Kudo et al. (2019) demonstrated that rapid or insufficient chewing is linked to excessive caloric intake, weight gain, and increased risk of metabolic disorders such as diabetes. Collectively, these findings underscore proper mastication as a modifiable factor in maintaining nutritional status and preventing metabolic disease across age groups.

Table 2. Chewing Parameters and Their Effects on Nutritional

No	Author(Year)	Subject	Chewing pattern parameters	Association Outcome
1	Ko et al. (2024)	Elderly	Quantity and quality of mastication	Nutritional status
2	Vucea, et al(2018)	Elderly	Food texture and size	Malnutrition
3	Kokura & Shimizu (2024)	Elderly	Food texture and size	Malnutrition
4	Chun et al (2022)	Adults and elderly	Food texture and size	Cardiovascular disease
5	Kim at al (2023)	Elderly	Food texture and size	Nutritional Status
6	Wu (2024)	Elderly	Quantity and quality of mastication	Nutritional Status
7	Borvornparadorn et al (2019)	Adults and elderly	Quantity and quality of mastication	Energy intake
8	Garcidueñas-Fimbres et al. (2023)	Children	Quantity and quality of mastication	Cardiometabolic risk
9	Mejean at al(2015)	Adults	Saliva Production	Nutrient intake
10	Chairani et al (2023)	Children	Quantity and quality of mastication	BMI
11	Kudo et al (2019)	Elderly	Quantity and quality of mastication	Diabetes
12	Iwasaki et al (2016)	Elderly	Saliva Production	Dietary intake
13	Fujimoto et al (2020)	Elderly	Quantity and quality of mastication	BMI
14	Motokawa Keiko et al (2021)	Elderly	Quantity and quality of mastication Food quality, size & texture	Nutrient
15	Okubo et al	Children	Quantity and quality of mastication Food quality, size & texture	Weigh Status

DISCUSSION

The findings from the 15 reviewed studies consistently indicate that impaired chewing patterns are associated with poor nutritional status, including malnutrition, reduced energy intake, and heightened risks of metabolic and cardiovascular disorders. However, these results should be interpreted cautiously due to several limitations. Most studies were conducted in East Asian contexts such as Japan, Korea, and China, where cultural norms regarding food texture, eating speed, and meal habits differ from those in other regions. This cultural concentration may limit the generalizability of the findings to broader populations.

Methodologically, most studies employed cross-sectional designs, which do not allow causal inferences. In addition, chewing parameters were measured using varied approaches, from subjective questionnaires to objective bite-force assessments, leading to inconsistent definitions and potential measurement bias. The lack of standardised assessment tools also hinders direct comparison across studies.

From a physiological standpoint, chewing plays a critical role in the early stages of digestion by mechanically breaking down food and stimulating saliva production, which enhances enzymatic activity (e.g., amylase). Effective chewing also activates satiety-

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regulating pathways through hormones such as cholecystokinin (CCK), supporting appetite control and balanced energy intake. These mechanisms suggest that chewing adequacy is not only a mechanical process but also a modifiable behavioural factor influencing nutritional health.

From a neurophysiological perspective, the chewing process is regulated by the central pattern generator (CPG) located in the brainstem, which coordinates rhythmic jaw movements through the interaction of the somatic and autonomic nervous systems. Muscles such as the masseter and temporalis are primarily responsible for generating chewing force. Dysfunction in these muscles or anomalies in jaw structure, such as temporomandibular joint disorders (TMJ), tooth loss, or malocclusion, can reduce masticatory efficiency and directly impair the ability to form a cohesive bolus for safe swallowing. Such conditions may not only hinder adequate food intake but also contribute to long-term nutritional deficiencies, particularly among older adults who experience reduced masticatory muscle mass.

Interestingly, several studies also highlight the association between eating speed and metabolic disorders such as obesity and diabetes. Fast eating habits are generally linked to reduced awareness of satiety signals, thereby increasing the likelihood of excessive energy intake. This observation is supported by findings from Kudo et al. (2019) and Borvornparadorn et al. (2019), which demonstrate that slower, more deliberate chewing significantly reduces caloric intake and lowers the risk of obesity[20], [22].

Risk of nutritional disorders based on the quantity and quality of chewing

The duration of chewing food affects how thoroughly food can be broken down into smaller particles. When food is chewed for a longer time, a larger surface area is available for digestive enzymes in saliva, which aid digestion in the stomach and intestines [4]. Proper chewing enhances nutrient absorption by breaking food into smaller particles and initiating digestion in the mouth. Chewing effectiveness is strongly influenced by maximum occlusion between the upper and lower teeth, which ensures optimal food grinding. When occlusion is poor—due to missing teeth, malocclusion, or unsuitable prostheses—the breakdown of food becomes less efficient, reducing nutrient absorption. In addition, masticatory muscle strength, jaw mobility, and adequate salivary flow also contribute to chewing efficiency. Together, these factors determine the quality of chewing, which directly affects digestion and overall nutritional status[17], [18]. Meanwhile, BMI is not directly related to chewing parameters; however, BMI is only one aspect of nutritional status and is influenced by various lifestyle factors such as physical activity, diet, and general health/disease status [2].

Research shows that individuals who are used to chewing faster tend to consume more food and have a tendency to develop obesity problems, and associated with higher adiposity, certain cardiometabolic risk factors, and lower adherence to a Mediterranean diet [19]. Further long-term and interventional studies are warranted to confirm these associations, while those who chew longer are more likely to feel full and eat an amount that is more in line with the body's energy needs [20], [21]. In addition to ensuring that food is broken down properly, the act of chewing is essential for maintaining oral health. Reduced capacity to chew, whether due to temporomandibular joint problems or structural dental issues, can increase the risk of malnutrition and digestive problems. This supports studies, which found that nutritional abnormalities, especially in older populations, can be exacerbated by chewing dysfunction [21].

Another important factor in chewing patterns is the condition of the masticatory muscles. The chewing process can be aggravated by a decrease in masticatory muscle strength, which is common in the elderly and those with degenerative disorders. This can directly affect food consumption and nutritional status. Weak muscle strength is associated with lower consumption of foods containing essential nutrients, which can lead to a decline in nutritional status and increase the risk of malnutrition [17]. The

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effectiveness of chewing depends on the function of the oral and jaw muscles. Conditions such as temporomandibular joint (TMJ) disorders can impair chewing, thereby reducing digestion efficiency and nutrient absorption. Eating too quickly results in food entering the stomach in larger particles, which can cause digestive discomfort and limit nutrient uptake. In contrast, chewing food slowly allows the digestive process to begin properly in the mouth, supporting better digestion and absorption [19]. The body's energy balance can be affected by suboptimal chewing habits. Chewing difficulties can cause people to eat more food to feel full after a meal or even change their perception of satiety, which can affect the amount of calories they consume [22], [23].

The relationship between chewing and health risks is multidimensional, spanning oral health to metabolic disorders. Inadequate chewing can leave larger food particles in the mouth, promoting bacterial growth and increasing the risk of plaque, tooth decay, and gum disease. However, this relationship is bidirectional: poor dental conditions such as missing teeth, cavities, or periodontal disease can also reduce chewing efficiency. This creates a reinforcing cycle in which impaired chewing contributes to oral health deterioration, which then further limits chewing ability and ultimately affects food intake and overall nutritional status[3].

Furthermore, rapid food consumption, characterised by inadequate chewing, has been linked to an increased risk of obesity and related metabolic conditions as it can interfere with the body's ability to effectively signal satiety. Studies show that individuals who chew their food thoroughly tend to consume fewer calories, which allows for better weight management and decreased incidence of lifestyle-related diseases such as Diabetes [22]. Rapid eating stands out as a unique risk factor among significant eating behaviors that contribute to the development of diabetes. Further research is necessary to assess the specific characteristics of fast eaters and to determine if refraining from fast eating can aid in the prevention of diabetes mellitus [20].

Longer chewing duration is associated with a lower risk of indigestion, which directly affects nutritional status; on the other hand, a faster chewing speed may result in less food being broken down, reducing the effectiveness of digestion and potentially compromising nutritional status, especially in individuals who are already malnourished or have digestive disorders [24]. It is known that longer chewing duration can increase the breakdown of food into smaller particles, which can improve the absorption of nutrients, especially macronutrients and micronutrients [25].

In addition, the psychological aspects of chewing cannot be ignored. Mindful chewing, where one consciously enjoys and maintains awareness of the eating process, has been linked to better mental health outcomes and improved digestive processes. This practice has the potential to reduce eating disorders and foster a healthier relationship with food. The longer the chewing, the lighter the digestive organs in the stomach, and the faster the absorption process. A satiety signal will also soon come from the hormone cholecystokinin (CCK), a hormone that regulates digestion and signals satiety [26]. With this mechanism, prolonged chewing triggers an earlier satiety signal, allowing the body to naturally stop eating without consuming a usual full portion—often only half or one-third of the normal amount. Increased chewing movements also enhance digestive efficiency by breaking food into finer particles and mixing it thoroughly with saliva, which supports better nutrient absorption in the gastrointestinal tract. This process plays an important role in maintaining the body’s nutritional balance. [17]

Risk of nutritional disorders based on food quality, size, and texture

Understanding our body's needs is essential for a successful diet programme. Instant drinks and flour-based foods should be limited because they place extra strain on the digestive system. Chewing habits are also influenced by food texture; harder foods like raw vegetables or meat require more chewing effort than softer or processed foods. These differences affect chewing time and how nutrients are digested and absorbed [27].

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Food fragments that are too large to fully digest can lead to bacterial overgrowth in the colon, which can cause indigestion, bloating, and constipation [8]. Dietary quality could modify the risk for CVD according to chewing status [13].

The nutritional value of food, which includes vitamins, minerals, protein, fat, carbohydrates, and fibre, is referred to as its quality. The body requires various essential nutrients found in high-quality foods to carry out various physiological processes. Conversely, low-quality foods, such as processed foods that are high in sugar and trans fats, can worsen nutritional status and increase the risk of a number of chronic diseases [10]. Eating low-quality food can damage teeth and gums, which can then impair a person's ability to chew food properly and increase their chances of experiencing additional nutritional problems [25].

Efficient chewing affects gut signalling and ultimately the digestion and absorption process [8]. Therefore, mastication and swallowing not only prepare food for safe passage from the oral cavity to the oesophagus but also aid in the subsequent events that occur in the stomach [28]. Foods rich in fibre may be more difficult for them to chew. Due to chewing difficulties, older people may be particularly vulnerable to nutrient deficiencies as they subsequently exclude high-fibre foods from their diet. A significant relationship has been shown between impaired chewing ability, food avoidance, and digestive disorders in older adults [9]. Coarse or hard-textured foods require more effort to chew and digest. In contrast, softer or finer foods facilitate breakdown and digestion, allowing the body to absorb nutrients more quickly and efficiently. For example, softer fruits and vegetables may offer nutrients that are more easily absorbed post-digestion compared to hard or high-fibre foods [29].

Food size and texture significantly affect chewing ability and nutrient intake, especially in individuals with dental, gastrointestinal, or masticatory problems [9].. Large or hard-to-chew foods can hinder digestion and reduce nutrient absorption, particularly in older adults with weakened chewing muscles [13]. Children and the elderly often struggle with chewing diverse, nutrient-rich foods, leading to imbalanced diets. To prevent nutrition-related issues, especially in vulnerable groups, it is important to offer softer, smaller, yet nutrient-dense foods that are easier to chew and digest [30].

Risk of nutritional disorders based on saliva production.

Saliva is essential for general dental health and the digestive process. Saliva contains digestive enzymes that initiate the breakdown of carbohydrates in the oral cavity, in addition to moisturising and lubricating food. In addition, sufficient saliva keeps the pH balance of the oral cavity stable and protects against tooth decay [31]. Therefore, changes in saliva flow may directly or indirectly contribute to nutritional problems. Chewing itself involves the coordinated work of the teeth, jaw muscles, and saliva to break food into smaller particles, making it easier to digest. This process is not merely mechanical; it plays a key role in early digestion, influencing nutrient absorption, taste perception, and the activation of digestive enzymes through the interaction between food and saliva [32]. During the chewing process, saliva is secreted by the salivary glands, which contain the enzyme amylase that helps break down carbohydrates. The amount of saliva produced can affect the extent to which food is digested before it reaches the stomach. In addition, saliva also helps soften food so that it is easier to swallow [33].

When food is chewed thoroughly, it becomes softer and mixes with more saliva. Salivary enzymes help break down food molecules, making them easier to absorb in the intestines. As a result, much of the digestion process begins in the mouth, reducing the workload on the stomach and allowing the intestines to absorb nutrients more efficiently. [34]. Saliva in adequate volume contains essential minerals such as calcium, phosphate, and fluoride that support the remineralization of early caries lesions. It also helps cleanse the mouth by reducing cariogenic microorganisms. In the chewing process, saliva is

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crucial for binding food particles into a cohesive bolus, allowing them to be swallowed safely[35].

The more efficient breakdown of starch made possible by sufficient saliva will increase the absorption of carbohydrates by the small intestine. Carbohydrate digestion is less effective in people with limited saliva production, such as those with xerostomia (dry mouth)[36]. Those who produce insufficient saliva have difficulty absorbing food energy, which increases the risk of nutrient and energy deficiencies. Decreased saliva production makes it more difficult to chew and swallow food, which often leads to eating less nutrient-dense foods or consuming fewer calories overall. Chewing disorders are often associated with decreased saliva production, which can have an impact on nutritional status [31]

Softer, easier-to-chew foods, such as processed foods or foods high in sugar and saturated fat, are often preferred by people with low saliva production because they are more nutrient-dense [37]. This can ultimately have an impact on nutritional status by causing nutritional imbalances. People who have difficulty swallowing because their saliva production is inadequate are more likely to choose foods that are low in nutrients, such as foods that are rich in calories and low in fiber, which increases the risk of becoming obese or malnourished [17]. Micronutrient deficiencies may also arise from dietary changes, as soft or easily swallowed foods often lack essential vitamins and minerals such as calcium, iron, vitamin C, and vitamin A. Reduced consumption of nutrient-dense foods can contribute to nutritional problems, particularly among older adults, and negatively impact overall health. These findings reinforce the need for behavior-based interventions that emphasize proper chewing habits as part of nutritional promotion strategies. To strengthen the evidence base, future research should employ longitudinal or interventional designs, with standardized measures of chewing patterns and careful control of cultural and oral health factors, to produce findings that are more accurate and broadly applicable.

CONCLUSION

This study concludes that chewing parameters—particularly duration, frequency, and food texture significantly influence nutritional status. Impaired chewing is linked to reduced energy intake, increased risk of malnutrition, and metabolic disorders, especially among older adults and those with oral health issues. Poor chewing quality limits effective digestion and nutrient absorption, emphasizing the need to incorporate proper chewing habits into public nutrition education. Targeted interventions, such as dietary counselling and food texture modification, are especially important for vulnerable groups, including the elderly, children, and individuals with reduced masticatory function. Future research should include participants with clinically identified oral conditions to clarify the health impacts of chewing difficulties. Additionally, developing standardized and validated tools for measuring chewing behaviour is necessary to enhance research consistency and support more effective intervention strategies.

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