RESEARCH PAPER

Ayurvedic Dairy Products and Their Pro-Obesity and Pro-Diabetic Potential: A Critical Appraisal Based on Caloric Content, Carbohydrate Value, and Glycaemic Index

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Abstract
Background: Obesity (*Sthaulya*) and diabetes mellitus (*Madhumeha*) represent two closely interlinked metabolic disorders of escalating global concern. The classical Ayurvedic text *Sushruta Samhita*delineates a category of dairy products — *Dugdha Varga* — and cautions against their unrestricted consumption in metabolically vulnerable individuals. The present review critically appraises this ancient dietary wisdom against contemporary nutritional parameters, specifically caloric density, carbohydrate content, and glycaemic index. Methods: A narrative review methodology was employed. Classical descriptions of five principal *Dugdha Varga* products — cow milk (*Godugdha*), curd (*Dadhi*), buttermilk (*Takra*), fresh butter (*Navanita*), and clarified butter (*Ghrita*) — as described in *Sushruta Samhita Sutrasthana* (chapters 45 and 46) and *Dhanvantari Nighantu* were retrieved, decoded, and mapped to their modern nutritional profiles sourced from peer-reviewed literature. Results: All five dairy products exhibit high caloric density per 100 g. Butter (3,400 kJ) and ghee (3,665 kJ) carry the greatest energy burden, accompanied by saturated fat concentrations of 50.0 g and 62.0 g, respectively. These Ayurvedic texts classify butter and ghee as *Kapha-Meda Karak* (promoters of adiposity), and curd as *Kaphakarak* and *Medovardhana* — consistent with their obesogenic and insulin-resistance-promoting nutritional profiles. Buttermilk (*Takra*) and, to a qualified extent, cow milk alone were identified as metabolically safer options within this group.
Conclusion: The dietary restrictions placed on *Dugdha Varga* by Sushruta for patients with obesity and diabetes find strong validation in modern nutritional science. Buttermilk and limited quantities of cow milk may be permissible; ghee, butter, and curd warrant strict dietary moderation in patients with *Sthaulya* and *Madhumeha*. This concordance between classical Ayurvedic observation and contemporary nutritional evidence underscores the translational relevance of Ayurvedic dietetics.
Keywords: *Dugdha Varga*; dairy products; Ayurveda; obesity; *Sthaulya*; diabetes mellitus; *Madhumeha*; glycaemic index; *Sushruta Samhita*; caloric density.
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1. Introduction

The dual epidemic of obesity and type 2 diabetes mellitus has become one of the defining public health challenges of the twenty-first century. Type 2 diabetes (T2D) affects approximately 463 million adults worldwide, and it is estimated to reach 700 million by 2045.[1]

According to the World Health Organisation (WHO) in 2022, worldwide 2.5 billion (43 %) adults aged 18 years or older were overweight, and 890 million (16 %) of these adults were living with obesity. [2]

Hence, it is essential to identify modifiable risk factors causing Type 2 diabetes and obesity.

Apart from genetic and environmental factors, risk factors for Type 2 diabetes include race, obesity, physical inactivity, advanced age, high blood pressure, and a sedentary lifestyle.[3]

Together, these conditions drive an enormous burden of cardiovascular morbidity, chronic kidney disease, and premature mortality across both high-income and low-to-middle-income countries. Pharmacological management, though advancing rapidly, continues to carry considerable adverse-effect profiles and does not adequately address the dietary aetiology that underlies these disorders.

Dairy products are important constituents of diet, and the hormones present in dairy products, especially milk, are considered essential for growth and immunity. Dairy products such as milk, buttermilk, curd, cheese, and butter are rich in calcium, vitamin D, vitamin A, magnesium, zinc, and protein and are considered essential for building healthy bones, teeth, gums, and maintaining a healthy weight.[4]

Ayurveda, the classical system of Indian medicine codified across texts such as *Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridayam*, contains elaborate dietary frameworks that categorise foods according to their impact on the three fundamental biological

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humours — *Vata*, *Pitta*, and *Kapha*. Within this framework, foods that aggravate *Kapha* are understood to promote adiposity, sluggish metabolism, and hyperglycaemia — conditions corresponding broadly to what contemporary medicine terms obesity and type 2 diabetes mellitus.

The *Dugdha Varga* (dairy product group) constitutes a prominently discussed category in *Sushruta Samhita Sutrasthana*, where individual dairy preparations are characterised according to their taste (*Rasa*), post-digestive taste (*Vipaka*), potency (*Virya*), and their doshic effects. Sushruta explicitly cautions against unrestricted dairy consumption in individuals predisposed to *Sthaulya* (obesity) and *Madhumeha* (diabetes mellitus). Moreover, ancient Ayurvedic scholar Sushruta had suggested stopping milk in type 2 diabetes mellitus. [5]

Despite the rich classical literature on Ayurvedic dietetics, systematic cross-referencing of these ancient characterisations with modern nutritional parameters — caloric density, saturated fat content, carbohydrate load, and glycaemic index — remains limited. Such an analysis is essential for establishing evidence-based dietary guidelines that can bridge traditional wisdom with contemporary clinical practice.

The present review aims to (i) retrieve and decode classical Ayurvedic descriptions of the five principal *Dugdha Varga* products, (ii) compare these descriptions with their established modern nutritional profiles, and (iii) evaluate whether Sushruta's dietary cautions in obesity and diabetes are supported by contemporary nutritional evidence.

2. Review of Classical Literature

The following five products constitute the *Sushrutokta Dugdha Varga* and are described in *Sushruta Samhita Sutrasthana* (Chapter 45) and the *Dhanvantari Nighantu*. The decoded classical descriptions are presented below, with Sanskrit source references cited by chapter and verse.

2.1 *Godugdha* (Cow Milk)

Cow milk is described in *Dhanvantari Nighantu* (6/152) as *Rasayana* (rejuvenating), *Balya* (strength-promoting), *Hridya* (cardiotonic), and *Kaphagna* (capable of moderating Kapha under appropriate quantity). Among the dairy products enumerated by Sushruta, cow milk occupies a nuanced position: while it is inherently *Snigdha* (unctuous) and *Guru* (heavy) and thus possesses Kapha-promoting qualities when consumed in excess, its therapeutic benefits in moderate quantity — including cognitive enhancement, physical restoration, and cardiac support — distinguish it from the unconditionally prohibited dairy preparations.[6]

2.2 *Dadhi* (Curd)— Sweet and Sour Varieties

Two varieties of curd are described in *Sushruta Samhita Sutrasthana* (45/66–67). *Madhura Dadhi* (sweet curd) is characterised as *Mahabhishyandi* (strongly obstructive to body channels), *Kaphakarak* (Kapha-promoting), and *Medovardhana* (fat-augmenting). *Amla Dadhi* (sour curd) is described as *Vidahi* (producing burning), causing loose stools and urinary frequency, and acting as *Tridoshakrit* (aggravating all three doshas) when consumed inappropriately. Both varieties, particularly sweet curd, are implicated in promoting adiposity and metabolic stagnation.[7]

2.3 *Takra* (Buttermilk)

Buttermilk receives a distinctly favourable characterisation across both *Sushruta Samhita* (45/84) and *Dhanvantari Nighantu* (6/195). It is described as *Madhura-Amla* (sweet-sour in taste), *Ushna Virya* (hot in potency), *Laghu* (light), and *Ruksha* (dry in quality). It kindles digestive fire (*Agnidipana*), relieves abdominal distension and splenomegaly, and is noted as *Kaphavata Nashaka* — effective in reducing both Kapha and Vata. Its lightness and warm potency make it a uniquely suitable dairy preparation for patients with metabolic disorders, as it does not augment fat deposition or provoke insulin resistance.[8][9]

2.4 *Navanita* (Fresh Butter)

Fresh butter, known as *Navanita* in classical texts, is described in *Sushruta Samhita Sutrasthana* (45/92) as light (*Laghu*), soft (*Sukumara*), sweet-tasting (*Madhura*), mildly astringent, cold in potency (*Shitala*), and beneficial for cardiac function and haemostasis. However, when consumed over time, it becomes heavy (*Guru*), strongly promotes Kapha and fat (*Kapha-Meda Karak*), and augments adipose tissue (*Brihana*). The verse specifically commends fresh butter for children and those requiring nutritional rehabilitation, but such a recommendation is explicitly context-dependent and does not apply to those with existing adiposity or dysglycaemia. [10]

2.5 *Ghrita* (Clarified Butter / Ghee)

Clarified butter (ghee) receives its most detailed description in *Sushruta Samhita Sutrasthana* (45/96), where it is characterised as *Madhura* (sweet), *Saumya* (gentle), *Mridu* (soft), and cold in potency (*Shita Virya*). It is credited with enhancing memory, intellect, voice, complexion, vitality, and longevity, and is classified as *Vrishya* (aphrodisiac) and *Medhya* (nootropic). Notwithstanding these therapeutic qualities, ghee is explicitly described as *Guru* (heavy), *Chaksushya* (beneficial for the eyes), and *Shleshmavardhana* — causing significant Kapha augmentation and thereby promoting fat accumulation in individuals with compromised metabolic function. The Kapha-promoting and fat-increasing properties of ghee are thus well-recognised within the classical framework itself, irrespective of its other therapeutic roles.[11]

3. Observations: Nutritional and Glycaemic Profile of *Dugdha Varga* (Dairy products)

Table 1 presents the nutritional composition per 100 g of the five *Dugdha Varga* products alongside their classical Ayurvedic doshic characterisations. The values represent established reference data for the respective food items.

Table 1. Nutritional composition and Ayurvedic doshic classification of Sushrutokta Dugdha Varga products (per 100 g)

Dairy Product	Calories (kJ)	Saturated Fat (g)	MUFA (g)	PUFA (g)	Trans Fat (g)	Protein (g)	Ayurvedic Doshic Properties
Cow Milk (Godugdha)	251	1.9	0.8	0.2	0.0	3.2	Kaphakarak, Snigdha, Guru; Hridya, Rasayana in limited quantity
Curd (Dadhi)	234	0.3	0.5	1.2	0.0	1.6	Kaphakarak, Medovardhana, Snigdha; Mahabhishyandi
Buttermilk (Takra)	205	0.5	0.3	0.05	0.0	4.0	Kapha-Vata Shamaka, Laghu, Ushna; Agnidipana
Butter (Navanita)	3,400	50.0	23.0	3.2	0.0	0.7	Kapha-Meda Karak, Guru, Brimhana; Snigdha, cold potency
Ghee (Ghrita)	3,665	62.0	28.7	3.7	4.0	0.0	Kapha-Bala Karak, Guru, Shleshmavardhana; Medhya, Rasayana

MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids. Ayurvedic properties as described in Sushruta Samhita Sutrasthana (Ch. 45) and Dhanvantari Nighantu (Ch. 6).

The data in Table 1 immediately highlight the extreme caloric burden carried by butter and ghee, at 3,400 kJ and 3,665 kJ per 100 g respectively — values that are approximately 14 to 17 times higher than those of fluid dairy products. Furthermore, the saturated fat content of ghee (62.0 g/100 g) and butter (50.0 g/100 g) substantially exceeds that of the three fluid products and represents a dietary concern well established in the context of insulin resistance and cardiovascular risk. Buttermilk, by contrast, carries the lowest fat burden among the group, with only 0.5 g of saturated fat per 100 g and a caloric value of 205 kJ/100 g. Its low glycaemic index, light quality (*Laghu*), and hot potency (*Ushna Virya*) align with its Ayurvedic characterisation as a metabolically safe dairy preparation.

The presence of trans fats in ghee (4.0 g/100 g) is of particular clinical significance. Naturally occurring trans fatty acids in ruminant-derived fats, while structurally distinct from industrially produced trans fats, have nonetheless been associated with adverse lipid profiles and insulin resistance in dose-dependent analyses. This nutritional profile reinforces the classical Ayurvedic designation of ghee as *Guru* and *Shleshmavardhana*.

4. Discussion

4.1 Concordance Between Ayurvedic Characterisations and Modern Nutritional Evidence

The characterisation of curd, butter, and ghee as *Kaphakarak* and *Medovardhana* — that is, as promoters of fat accumulation and metabolic torpor — finds considerable support in contemporary nutritional science. Diets high in saturated fat have been consistently linked to impaired insulin signalling, increased visceral adiposity, and dysregulation of the adipokine axis. Butter and ghee, carrying 50.0 g and 62.0 g of saturated fat per 100 g respectively, represent among the most energy-dense and lipid-rich foods in any dietary system.

The Ayurvedic concept of *Mahabhishyandi* — literally, that which blocks and obstructs the body's micro-channels (*Srotas*) — applied to sweet curd has mechanistic parallels with the modern understanding of high-fat, high-carbohydrate meals inducing endothelial dysfunction and peripheral insulin resistance. Such convergence between classical observational categories and molecular-level physiology is methodologically noteworthy.

Cow milk's dual characterisation — as *Kaphakarak* in excess, yet *Hridya* (cardiotonic) and *Rasayana* (rejuvenating) in measured quantity — resonates with a nuanced finding from contemporary epidemiology. The Nutrigrade meta-analytic framework observed an approximately 5% reduction in stroke risk associated with progressive dairy intake up to approximately 500 g/day, while no adverse association was observed for

coronary heart disease at moderate consumption levels.[4] These findings suggest that cow milk, consumed in moderation, may occupy a cautiously permissible role in dietary management, consistent with the classical Ayurvedic position.

4.2 Cardiovascular Risk and Dairy: Evidence from Modern Studies

Avalos et al. [12] evaluated the association between dairy product consumption and coronary heart disease (CHD) incidence in a prospective observational cohort and concluded that dairy consumption was not uniformly associated with CHD risk, with the relationship varying by dairy product type. This finding parallels Sushruta's product-specific dietary guidance rather than any blanket prohibition on dairy.

Bergholdt et al. [13] conducted a large-scale observational and Mendelian randomisation analysis in 98,529 Danish adults and found that milk intake was not associated with ischaemic heart disease when potential confounders were controlled using genetic instruments. This evidence is consistent with the classical exemption of *Godugdha* from strict prohibition.

The systematic review and meta-analysis by Alexander et al. [14] across multiple cohort studies further substantiated that dairy consumption, in aggregate, did not confer a significant increase in cardiovascular disease risk. However, this analysis acknowledged heterogeneity across dairy sub-types, echoing the product-specific differentiation central to the *Dugdha Varga* framework.

Praagman et al. [15] in the Rotterdam Study found that dairy products demonstrated variable associations with stroke and coronary heart disease risk depending on their fat content and fermentation status — a conclusion that reinforces the classical Ayurvedic framework's differentiated treatment of the five *Dugdha Varga* preparations.

4.3 Buttermilk as the Principal Permissible Dairy Product

Among the five *Dugdha Varga* preparations, buttermilk (*Takra*) emerges unambiguously as the most metabolically appropriate option for patients with *Sthaulya* and *Madhumeha*. Its low caloric density (205 kJ/100 g), minimal saturated fat content, high protein concentration (4.0 g/100 g), and Ayurvedic description as *Laghu*, *Ushna*, and *Agnidipana* collectively suggest a product that supports digestive metabolism, promotes thermogenesis, and avoids lipid and glycaemic loading. The probiotic constituents of buttermilk additionally confer potential benefits for gut microbiome modulation, which is increasingly recognised as a determinant of metabolic phenotype.

4.4 Contextualising the Use of Ghee

The present analysis does not contend that ghee is without therapeutic merit in Ayurvedic medicine — classical texts including *Charaka Samhita* and *Ashtanga Hridayam* document its use in medicated formulations (*Ghrita Kalpana*), rasayana therapy, and specific neurological and ophthalmic conditions. Rather, the current appraisal specifically addresses dietary ghee consumption in the context of metabolic disorders, where its extreme caloric, saturated fat, and trans fat burden clearly contraindicate unrestricted use. The dose-context distinction — ghee as medicine versus ghee as dietary staple — is itself consonant with the Ayurvedic principle of *Matra* (dose appropriateness).

Dairy and Diabetes Risk

A few studies have shown the harmful effects of dairy, especially whole milk or unfermented milk. [16]

There are three big risk factors linking milk to diabetes.

1. Sugar and carbohydrate content of Milk

Milk contains 12 to 13 grams of carbohydrates per 8-ounce bottle. It is mainly in the form of lactose, to which many are intolerant. Carbohydrates cause an elevation in blood sugar levels.[17] [18]

2. Fat Content of Milk

Milk is very high in fat content. Milk contains 3.5 to 5% fat, of which 65% is in the form of unsaturated fats. High unsaturated fat content is directly linked to high blood cholesterol and heart disease. When fat gets into the cells, it prevents glucose and insulin in the blood from entering the muscle cells. This insulin resistance leads to type 2 Diabetes. [19]

3. Insulin-like Growth Factor (IGF)

Milk contains the hormone IGF. These IGF molecules look like insulin, but function in the opposite way to insulin. They do not function like insulin. They do not allow the intake of glucose from the blood into the cell. This is a reason why stopping milk and all milk products results in lowering blood sugar levels.[20] [21]

5. Conclusion

This critical appraisal demonstrates that the classical Ayurvedic dietary cautions articulated by Sushruta regarding the *Dugdha Varga* products are well-supported by contemporary nutritional and epidemiological evidence. The classification of curd, butter, and ghee as *Kaphakarak* and *Medovardhana* is reflected in their high caloric density, elevated saturated fat content, and potential to promote adiposity and insulin resistance.

Buttermilk (*Takra*) emerges as the most appropriate dairy product for patients with *Sthaulya* and *Madhumeha*, while cow milk (*Godugdha*) may be consumed in carefully measured quantities given its modest caloric profile and documented cardiovascular neutrality in epidemiological studies. Butter and ghee, as dietary staples in patients with metabolic disorders, are contraindicated by both classical Ayurvedic reasoning and modern nutritional science. This convergence between ancient observational medicine and contemporary evidence-based nutrition highlights the clinical utility of revisiting Ayurvedic dietary frameworks through a rigorous scientific lens. Even after extensive research investigating the link between dairy consumption and risk of T2D, there is a wide range of mixed findings resulting in significant uncertainty. Hence, additional studies are required to further validate and operationalise dietary prohibition of milk products, exploring confounding factors such as race, geographic localization, ethnicity, dietary patterns, food intake behavior, and lifestyle factors are needed to ascertain the

potential detrimental effects of Ayurvedic *Dugdha Varga* preparations in patients with obesity and type 2 diabetes mellitus.

6. Declarations

Conflict of Interest: The authors declare no conflicts of interest.

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Ethical Approval: Not applicable. This article is a narrative review based entirely on published literature and classical textual sources and does not involve human or animal subjects.

Data Availability: All data supporting the findings of this review are available from the cited references.

7. References

1. The following references conform to the Vancouver citation style. Only sources explicitly cited in the text are listed. Classical Ayurvedic primary sources are cited by text, chapter, and verse number in accordance with standard Indological notation.
1. International Diabetes Federation. Brussels (Belgium): International Diabetes Federation; 2019. IDF Diabetes Atlas. 9th edition [Internet] [cited 2020 Feb 15]. Available from: https://www.diabetesatlas.org. [Google Scholar]
2. World Health Organization, 2024a. Obesity and overweight [WWW Document]. World Health Organization. URL https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight# (accessed 10.14.21).
3. American Diabetes Association . Arlington (VA): American Diabetes Association; 2019. Diabetes risk [Internet] [cited 2020 Feb 15]. Available from: https://www.diabetes.org/diabetes-risk. [Google Scholar]
4. Gil Á, Ortega RM. Introduction and executive summary of the supplement, role of milk and dairy products in health and prevention of noncommunicable chronic diseases: a series of systematic reviews. Adv Nutr. 2019;10(suppl_2):S67–73. doi: 10.1093/advances/nmz020. [DOI] [PMC free article] [PubMed] [Google Scholar]
5. Anant Ram Sharma (Editor), Sushruta Samhita of Maharshi Sushruta, Volume 1, Sutrasthana, chapter 11, Verse no. 5, reprint edition 2008, published by Choukhamba Surbharati Prakashan, Varanasi - 221001, pg. 268
6. Zharkhande Oza and Umapati Mishra (editors and translators), Dhanwantari Nighantu of acharya Dhanwantari, chapter 6, verse no. 152, reprint edition, published by Chaukhamba Surbharati Publication, Gopal Mandir Lane, Varanasi – 221001, pg.277
7. Anant Ram Sharma (Editor), Sushruta Samhita of Maharshi Sushruta, Volume 1, Sutrasthana, chapter 45, Verse no. 66-67, reprint edition 2008, published by Choukhamba Surbharati Prakashan, Varanasi - 221001, pg. 361
8. Anant Ram Sharma (Editor), Sushruta Samhita of Maharshi Sushruta, Volume 1, Sutrasthana, chapter 45, Verse no. 84, reprint edition 2008, published by Choukhamba Surbharati Prakashan, Varanasi - 221001, pg. 363
9. Zharkhande Oza and Umapati Mishra (editors and translators), Dhanwantari Nighantu of acharya Dhanwantari, chapter 6, verse no. 195, reprint edition, published by Chaukhamba Surbharati Publication, Gopal Mandir Lane, Varanasi – 221001, pg.286
10. Anant Ram Sharma (Editor), Sushruta Samhita of Maharshi Sushruta, Volume 1, Sutrasthana, chapter 45, Verse no. 92, reprint edition 2008, published by Choukhamba Surbharati Prakashan, Varanasi - 221001, pg. 365
11. Anant Ram Sharma (Editor), Sushruta Samhita of Maharshi Sushruta, Volume 1, Sutrasthana, chapter 45, Verse no. 96, reprint edition 2008, published by Choukhamba Surbharati Prakashan, Varanasi - 221001, pg. 366
12. Avalos EE, Barrett-Connor E, Kritz-Silverstein D, Wingard DL, Bergstrom JN, Al-Delaimy WK. Is dairy product consumption associated with the incidence of CHD? Public Health Nutr. 2013;16(11):2055–63. doi:10.1017/S1368980012004168
13. Bergholdt HK, Nordestgaard BG, Varbo A, Ellervik C. Milk intake is not associated with ischaemic heart disease in observational or Mendelian randomisation analyses in 98,529 Danish adults. Int J Epidemiol. 2015;44(2):587–603. doi:10.1093/ije/dyv109
14. Alexander DD, Bylsma LC, Vargas AJ, Cohen SS, Doucette A, Mohamed M, et al. Dairy consumption and CVD: a systematic review and meta-analysis. Br J Nutr. 2016;115(4):737–50. doi:10.1017/S0007114515005000
15. Praagman J, Franco OH, Ikram MA, Soedamah-Muthu SS, Engberink MF, van Rooij FJ, et al. Dairy products and the risk of stroke and coronary heart disease: the Rotterdam Study. Eur J Nutr. 2015;54(6):981–90. doi:10.1007/s00394-014-0774-2
16. Choi HK, Willett WC, Stampfer MJ, Rimm E, Hu FB. Dairy consumption and risk of type 2 diabetes mellitus in men: a prospective study. Arch Intern Med. 2005;165:997–1003. doi: 10.1001/archinte.165.9.997. [DOI] [PubMed] [Google Scholar]
17. Jenness R. The composition of human milk. Semin Perinatol. 1979 Jul;3(3):225-39. PMID: 392766.
18. I.C. Antunes, C. Roseiro, R. Bexiga, C. Pinto, M. Lageiro, H. Gonçalves, M.A.G. Quaresma, Carbohydrate composition of cow milk and plant-based milk alternatives,

Journal of Dairy Science, Volume 108, Issue 1,2025, Pages 164-172, https://doi.org/10.3168/jds.2024-25393.

19. Kala, Robert & Samková, Eva & Pecová, Lenka & Hanuš, Oto & Sekmokas, Kęstutis & Riaukienė, Dalia. (2018). An Overview of Determination of Milk Fat: Development, Quality Control Measures, and Application. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis. 66. 1055-1064. 10.11118/actaun201866041055.
20. Grijalva-Avila JC, Villanueva-Fierro I, Martínez-Estrada SC, Grijalva-Avila G, Gándara-Mireles A, Rivera G, Loera-Castañeda A, Almanza-Reyes H, Patrón-Romero L, Loera-Castañeda V. Effects of IGF1 rs6214 Polymorphism and Milk Consumption on Serum Levels of IGF-1 and GH and Body Composition. Metabolites. 2025 Aug 20;15(8):556. doi: 10.3390/metabo15080556. PMID: 40863172; PMCID: PMC12388142.
21. Malekinejad H, Rezabakhsh A. Hormones in dairy foods and their impact on public health - a narrative review article. Iran J Public Health. 2015;44:742–58. [PMC free article] [PubMed] [Google Scholar]