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Preparation of Functional Milk Beverages Fortified with Coconut Extract

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Abstract

Functional dairy beverages was prepared by using 1% whey protein concentrate, 10% coconut extract, 0.08% Dariloid, 5% sugar, skim milk, mixture was homogenized. Heated at 85°C for 15 min. rapidly cooled, bottled in sterilized stopper glass bottles and storage at 5°C±1. Samples were analyzed chemically, Sensory evaluation and microbiological analysis Results showed that beverage was 10% coconut and 1% whey protein concentrate gained high score for appearance, flavour and Taste fresh and during storage. pH decreased by increasing cold storage. Treatment had higher pH than control. Acidity took an opposite trend. Total solids increased by increasing cold storage at 5°C±1. Viscosity is higher in treatment than control and increased by increasing cold storage at 5°C±1. Amino acids: Treatment had higher content of Glutamic, Arginine Threonine and Leucine than control. Minerals: Treatment had higher content of Fe, Zn, Ca, K, Na which is very important for school children and old age. Microbiological analysis showed that total count, psychotropic bacterial, increased by increasing cold storage. Samples free from yeast and mould. Resultant beverage had higher content of L-Arginine which improves the immune and antioxidant characteristics that cure inflammatory bowel disease. Also contain bioactive components including lactoferrine. PER1, PER2 (protein efficiency ratio) are higher in treatment than control also BV (Biological value) for juveniles is higher in treatment than control.

Keywords: Functional Beverages, whey protein concentrate, coconut extract, skim milk, amino acids, sensory evaluation.

Introduction

Milk is considered an early complete food because it is a good source of protein, fat and major minerals. Also milk and a milk product is main constituent of the daily diet, especially for infant's school age children and old age.

Functional food can be defined as food containing significant levels of biologically active components that provide specific health benefit beyond the traditional nutrients they contain [1]. A Food marketed as functional contains added, technologically developed ingredients with specific health benefit [2]. Functional food is a nutritional food that has a positive effect on human health [3].

Whey protein is by-product derived from the production of cheese and has many benefits for human health. Whey protein is absorbed and digested rapidly. Whey protein contains a number of bioactive components including β loctoglobuln, α lactoalbumin, serum albumin, immunoglobulin and lactoferrin. These components have positive effects on health. Such as immune improving and antioxidant characteristic that reduces hypertension, cancer, and cure inflammatory bowel disease (IBD) and rich source of branched chain amino acids.

Some recent studies have been shown that coconut has helpful in the health of the gastro intestinal tract due to its antibacterial activity. The effect of coconut proteins is the high content of L-arginine [4].Coconut sap contains high sucrose and other nutrient that suitable for growth of bacteria and yeast and potent to use for producing probiotic drink such as yogurt [5].

The aim of this work is preparation of functional milk beverage from whey and fortified with coconut extract for school age children and old age to improve the immune and antioxidant characteristic that reduce hypertension and cure inflammatory bowel diseases.

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Materials and Methods:

I- Materials

Preparation of functional milk beverage fortified with coconut extract.

1% whey protein concentrates dissolving in mixture of skim milk 90% and 10% of coconut extract. 5% sucrose, 0.08% Dariloid as stabilizer. All mixture was homogenized and heated to 85°C for 15 min and cooled rapidly then bottled at sterilized stopper glass bottle and stored at 5°C ± 1. Samples were analyzed Sensory evaluation, chemically and microbiologically fresh and after 3, 5, 7, 10 days of cold storage at 5°C ± 1.

Preliminary experiments

Preliminary experiments were carried out to select the best ratio of coconut extract. It is adding by 5, 10, 15 and 20% to choose the best ratio. Sensory evaluation showed that 10% of coconut extract is the best ratio and had gained highest score for flavour, taste and appearance.

Preparation of aqueous extract of coconut according to [6] with some modification 50 gm dry spices of coconut was putting in 100 ml water for day before using. Then it was homogenized. The solution was filtered by the muslin cloth and the resultant was heated at 60°C for 30 min.

Coconuts, sugar were procured from the local market. Fresh cow milk was obtained from the faculty of Argic. Cairo, University.

II – Method:

1-Chemical analysis

Total solids (TS) and ash contents were done according to [7]. The pH values were measured using a digital pH meter equipped with a combined electrode (Hanna, Germany) and the titratable acidity was determined as described by [8]. Lactose was determined according to [9]. Minerals contents were determined by microwave digestion lab. Station, 1CP technique optima 2000 DV.

Viscosity: Apparent viscosity was measured using a Brookfield DV digital viscometer (Brookfield Engineering, Middleborough, MA, USA) with spindle no. 4 at 60 rpm. Apparent viscosity was expressed as Pascal - Pa·s.

Amino acids were performed according to **[10]** using an amino acid analyzer (Biochrom 30). The protein efficiency ratios (PER) of samples were based on their amino acid.

According to the recommendations of [11]**,** the following equations were used:

PER_1 = - 0.684 + 0.455 = (leucine- 0.047 (Proline) (for adults).

PER_2 = - 0.468 + 0.454 (leucine) – 0.105 (Tyrosine) (for juveniles).

Biological value (BV) was assayed according to the following equation as recommended to **[12]**

BV=49.9 + 10.53 PER

1- Stabilizer: Dariloid 100 (Guar Gum, xanthan gum, locust bean gum) produced by kelco division of Merck and co. Inc. U.S.A.

2-Ultrafiltered whey protein concentrate powder was obtained from Bio-pharm. Company A.R.E.

Fresh skim cow's milk analyzed for chemical composition. Fat was 0.3, TP 3.8, lactose 5.7, Ash 0.9%, TS 14.50, acidity 0.18 and pH 6.6. Also coconut extract was analyzed for the same contents of cow's milk; fat was 0.15%, TP 0.7%, Ash 0.47%, acidity 0.14% and pH 6.8.

2-Microbiological analysis:

Total viable bacterial counts

Total viable bacterial counts of all samples were determined by using standard plate count agar medium (oxoid) according to [13]. The plates were incubated at 35 ± 2°C for 48 h.

Mould and yeast counts

Mould and yeast counts of all samples were determined by using potato dextrose agar (oxiod) according to [14]. The plates were incubated at 25°C for 3 days and the result was expressed as colony forming units per ml (log CFU/ml).

Psychrotrophic enumeration:

Psychrotrophilic bacteria were enumerated according to standard methods for the examination of dairy products [15]. The plates were incubated aerobically at 70°C for 10 days.

Sensory evaluation:

Beverages were sensory evaluated using scale of points for 40 flavour, 40 points for taste and 20 points for appearance.

Statistical analysis

The Vassar Stats (http: //www. faculty.vassar.edu/Lowry/anova2corr.html) computing site was used to analyze the obtained data statistically by A nova of two independent variables according to [16].

Results and Discussion

Table1: Sensory evaluation of functional beverage fortified with 1% whey protein concentrate and different ratios of coconut extract

Ratios	Flavour (40)	Taste (40)	Appearance (20)	Total (100)
5%	35	36	19	90
10%	39	37	20	96
15%	33	35	18	86
20%	30	31	17	78
Control	39	35	20	94

Samples were judged by 20 persons of the colleague staff members.

Table (1) show the Sensory evaluation, of functional milk beverages fortified with 1% whey protein concentrate and different ratios of coconut extract. It is clear that 10% of coconut extract had gained a highest score for flavor, taste and appearance than other treatments. Also data illustrated in table (1) show that addition of coconut extract improved the quality of the beverage, in comparison with the control. 10% was the best and had a desirable flavour and appearance also 1% whey protein concentrate is a best ratio [17, 18].

Table 2: Effect of cold storage at 5°C ± 1 on sensory evaluation of functional milk beverages fortified with 10% coconut extract

Storage period/days	Flavour (40)	±SD	Taste (40)	±SD	Appearance (20)	±SD	Total (100)
Fresh	39^{a}	0.5773	38^{a}	0.5773	19^{a}	0.5773	96
3	37^{b}	0.5773	36^{b}	1.0000	18^{b}	1.1547	91
5	35^{c}	0.5773	33^{c}	0.5773	17^{bc}	0.5773	85
7	32^{d}	1.0000	31^{d}	1.0000	16^{c}	0.5773	79
10	30^{d}	1.0000	29^{d}	0.5773	14^{d}	0.5773	73

Dissimilar superscripts at the same row for treatments are significantly differed ($P < 0.05$). Each value is a mean of 3 replicates.

Table (2) illustrates the effect of cold storage at 5°C ± 1° on Sensory evaluation of functional milk beverage fortified with best ration of coconut (10%). Data shows that fresh functional milk had gained highest score for flavour, taste and appearance followed by 3 days. Score points of functional milk beverage gradually decreased by increasing the cold storage until 10 days. These results are in agreement with [6]. Statistical analysis shows that no significant at α 0.05 for cold storage until 10 days for treatment.

Table 3: Effect of cold storage at 5°C ± 1°on total solids, acidity and pH of functional milk beverage

Storage period days	pH		± SE	Acidity		± SE	TS		± SE
	C	T		C	T		C	T	
Fresh	6.77^{b}	6.79^{b}	0.040276	0.18^{a}	0.16^{a}	0.00471	14.73^{b}	16.00^{a}	0.168835
3	6.75^{b}	6.76^{b}	0.004714	0.20^{a}	0.18^{b}	0.00527	14.92^{b}	18.21^{a}	0.0097183
5	6.73^{b}	6.74^{b}	0.005773	0.25^{b}	0.23^{a}	0.00471	15.12^{b}	20.42^{b}	2.350328
7	6.72^{b}	6.70^{b}	0.009128	0.28^{b}	0.30^{a}	0.00471	16.06^{b}	22.11^{a}	0.1724497
10	6.70^{a}	6.68^{b}	0.015986	0.32^{b}	0.35^{b}	0.01027	18.69^{b}	24.13^{a}	0.0102740

C = Control **T = Treatment**

Dissimilar superscripts at the same row for treatments are significantly differed (P < 0.05). Each value is a mean of 3 replicates.

Table (3) indicated the acidity, pH and total solid of functional milk beverage fresh and during cold storage at 5°C ± 1 pH. It is clear that pH decreased by increasing the cold storage until 10 days and treatment had a higher pH than control fresh and during cold storage whereas acidity took an opposite trend it increased by increasing cold storage until 10 days.

Total solids:

The same table shows the total solids content of functional milk beverages. Treatment had higher TS than control either fresh or during storage. TS increased by increasing the cold storage at 5°C + 1 until 10 days. These results are in agreement to [17]. Statistical analysis shows that no significant at α 0.05 for cold storage until 10 days for pH, Acidity and Total Solids.

Viscosity:

Effect of cold storage at 5°C ± 1 on viscosity (pa.s) of functional milk beverage. From the data presented in figs (1, 2, 3, 4, and 5) indicated that treatment had higher viscosity (pa. s) than control either fresh or during cold storage. Viscosity (pa.s) increased by increasing the storage. These results are in agreement with [17, [19].

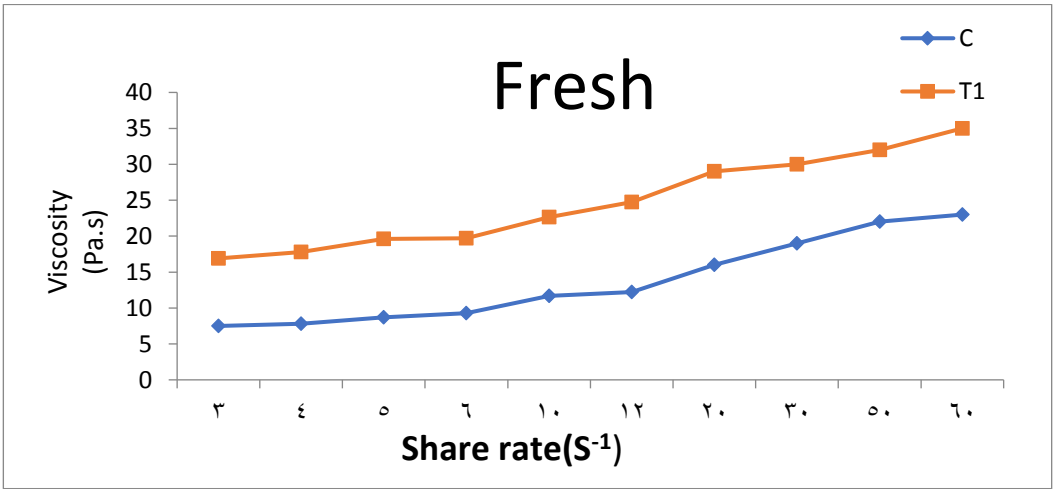

Fig. 1

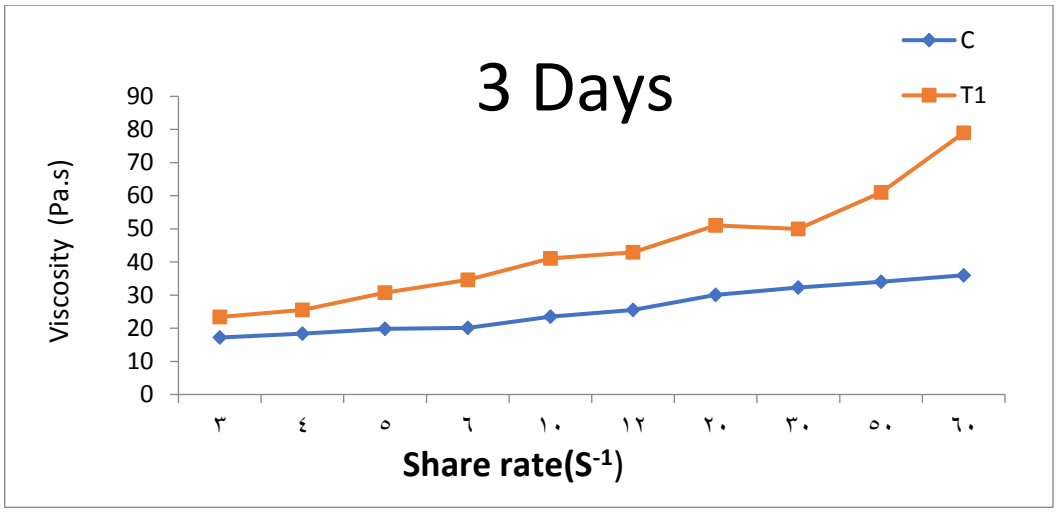

Fig. 2

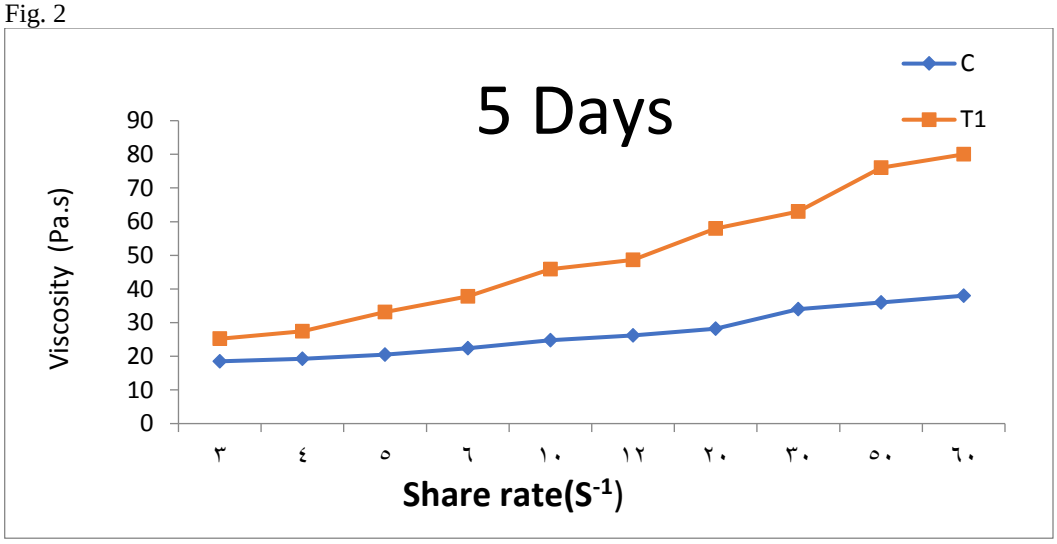

Fig. 3

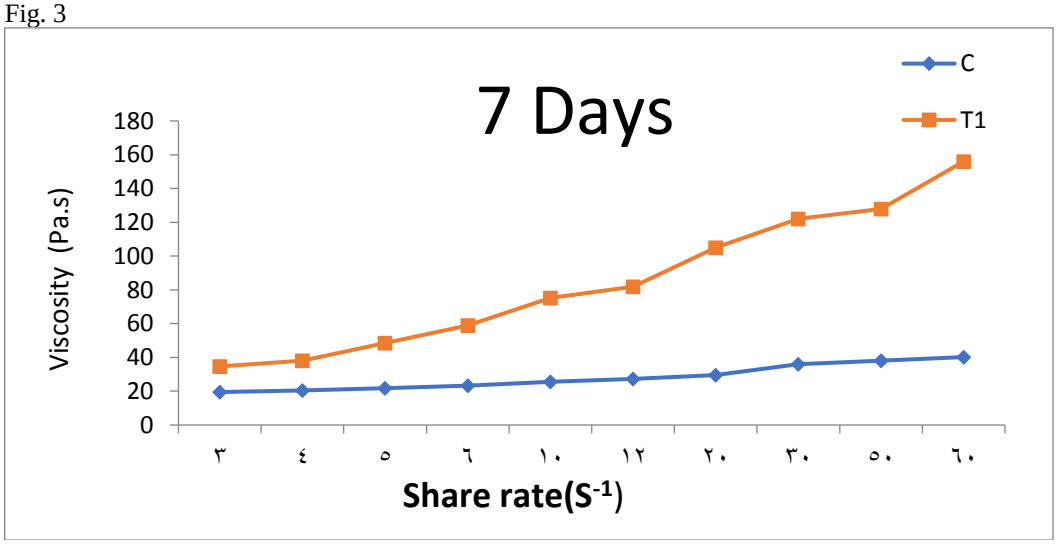

Fig. 4

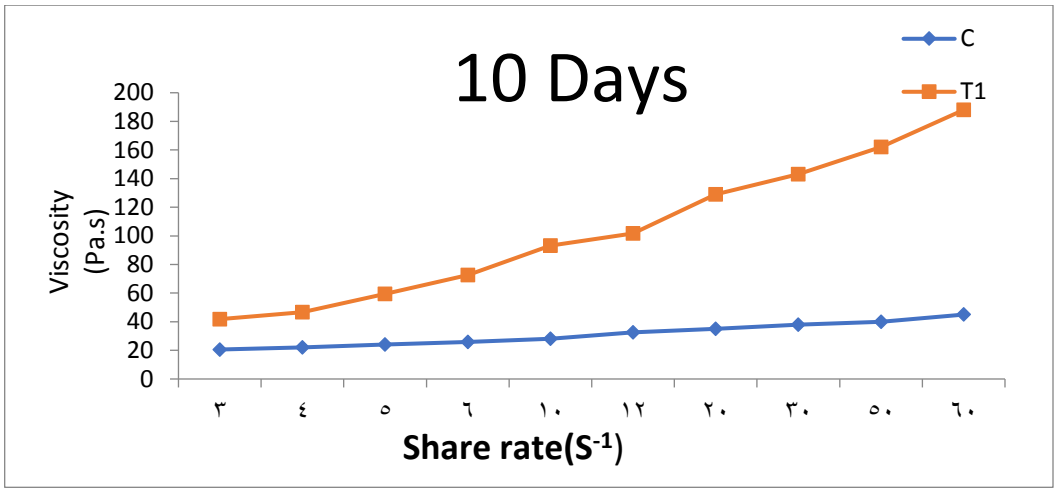

Fig. 5

Table 4: Amino acids content of functional milk beverage (mg/gm) protein

Amino acids	mg/gm protein	
	C	T
Aspartic	51.66	67.53
Glutamic	90.40	202.06
Serine	44.57	43.50
Glycine	29.92	23.75
Histidine	17.68	16.97
Arginine	19.85	22.33
Threonine	108.25	180.81
Alanine	41.07	35.72
Proline	84.43	43.63
Tyrosine	49.16	36.85
Valine	95.47	65.29
Methionine	143.16	50.20
Cysteine	2.58	0.18
Isoleucine	13.81	20.04
Phenylalanine	41.56	31.39
Lysine	64.73	55.29
Leucien	41.89	43.40

C = control
T = Treatment

Table (4) illustrate the amino acids content of functional milk beverage, control and treatment had aspartic, glutamic, serine Glycine, Histidine, Arginine Threonine, Alanine, Proline, Tyrosine, Valine, Methionine Cysteine isoleucine phenylalanine lysine and leucine.

Treatment had higher content of glutamic, arginine threonine and leucine than control. This is agreement with [4] who reported that coconut extract has helpful in the health and contains high content of L-arginine whereas control contains high content of methionine, lysine and cysteine.

Table (5) indicated the minerals content of functional milk beverage (mg/100g). We notice that treatment had a higher content of Fe, Zn, Ca, K and Na. These minerals are very important for children and old age. These results are in agreement with [20].

Table 5: Minerals content of functional milk beverage (mg/100gm)

Samples	Fe	Zn	Ca	K	Na
Control	14.70	0.46	116.05	123.78	154.73
Treatment	16.95	0.84	198.14	124.90	169.51

Each value is a mean of 3 replicates.

Table 6: Total viable bacterial counts (log CFU/ml) of functional milk beverage fortified with coconut extract fresh and during cold storage at 5°C ± 1°C

Storage period (days)	Control	±SD	Treatment	±SD
Fresh	5.72^{c}	0.0200	4.41^{d}	0.0100
3	5.91^{b}	0.0265	4.58^{c}	0.0100
5	6.10^{a}	0.1000	4.76^{b}	0.0100
7	6.10^{a}	0.1000	5.00^{a}	0.1159
10	6.15^{a}	0.0300	5.20^{a}	0.0361

Dissimilar superscripts at the same row for treatments are significantly differed (P < 0.05). Each value is a mean of 3 replicates.

Table (6) show that total counts of control ranged from 5.72 to 6.15 logs CFU/ml whereas it ranged from 4.41 to 5.20 CFU/ml of treatment. Total viable bacterial counts (log CFU/ml) increased by increasing the storage time either control or treatment. This may be due to the activity of microbes during cold storage at 5°C ± 1. Statistical analysis shows that no significant at α 0.05 for cold storage until 10 days.

Table 7: **Total psychrotrophic bacterial counts (Log CFU/ml) of functional milk beverage fortified with coconut extract fresh and during cold storage at 5°C ± 1**

Storage Period (days)	Control	±SD	Treatment	±SD
Fresh	4.30^{b}	0.0500	4.00^{e}	0.0710
3	4.45^{b}	0.0300	4.11^{d}	0.0608
5	4.57^{b}	0.0458	4.28^{c}	0.0252
7	4.75^{a}	0.0364	4.36^{b}	0.0400
10	4.83^{a}	0.0252	4.52^{a}	0.0200

Dissimilar superscripts at the same row for treatments are significantly differed (P < 0.05). Each value is a mean of 3 replicates.

Table (7) indicates the psychrotrophic bacterial counts (log CFU/ml) of control and treatment. It is clear that total psychrotrophic bacteria increased from 4.30 to 4.83 for control and from 4.00 to 4.52 (log CFU/ml) for treatment during cold storage at 5°C ± 1 and control had higher count of psychrotrophic bacteria than treatment either fresh or during cold storage at 5°C ± 1. Statistical analysis shows that no significant at α 0.05 for cold storage until 10 days.

Mould and Yeast:

All samples were free from mould and yeast either fresh or during cold storage at 5°C ± 1.

Table (8) show protein efficiency ratio (PER) and biological value (BV) for adult and juvenile, it is clear that PER_1 and PER_2 are higher in treatment than control. This may be due to the higher content of the amino acid of leucine and proline in treatment than control for adult and juveniles on the other hand BV_2 biological value for juveniles is higher in treatment than control. These attributed to the PER protein efficiency ratio. These results are in agreement to [21].

Table 8: Protein efficiency ratio (PER) and biological value (BV) of functional milk beverage

	Control	Treatment
PER_1	14.45	17.06
PER_2	5.16	15.37
BV_1	202.06	184.50
BV_2	104.34	211.75
	1 Adult	2 Juveniles

Conclusion:

Preparation functional milk beverage fortified with 1% whey protein concentrate and 10% coconut extract is useful for school children and old age because coconut extract had higher content of L-arginine and improve the immune and antioxidant characteristic that cure inflammatory bowel diseases. also beverage contains bioactive components including lactoferrin.

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