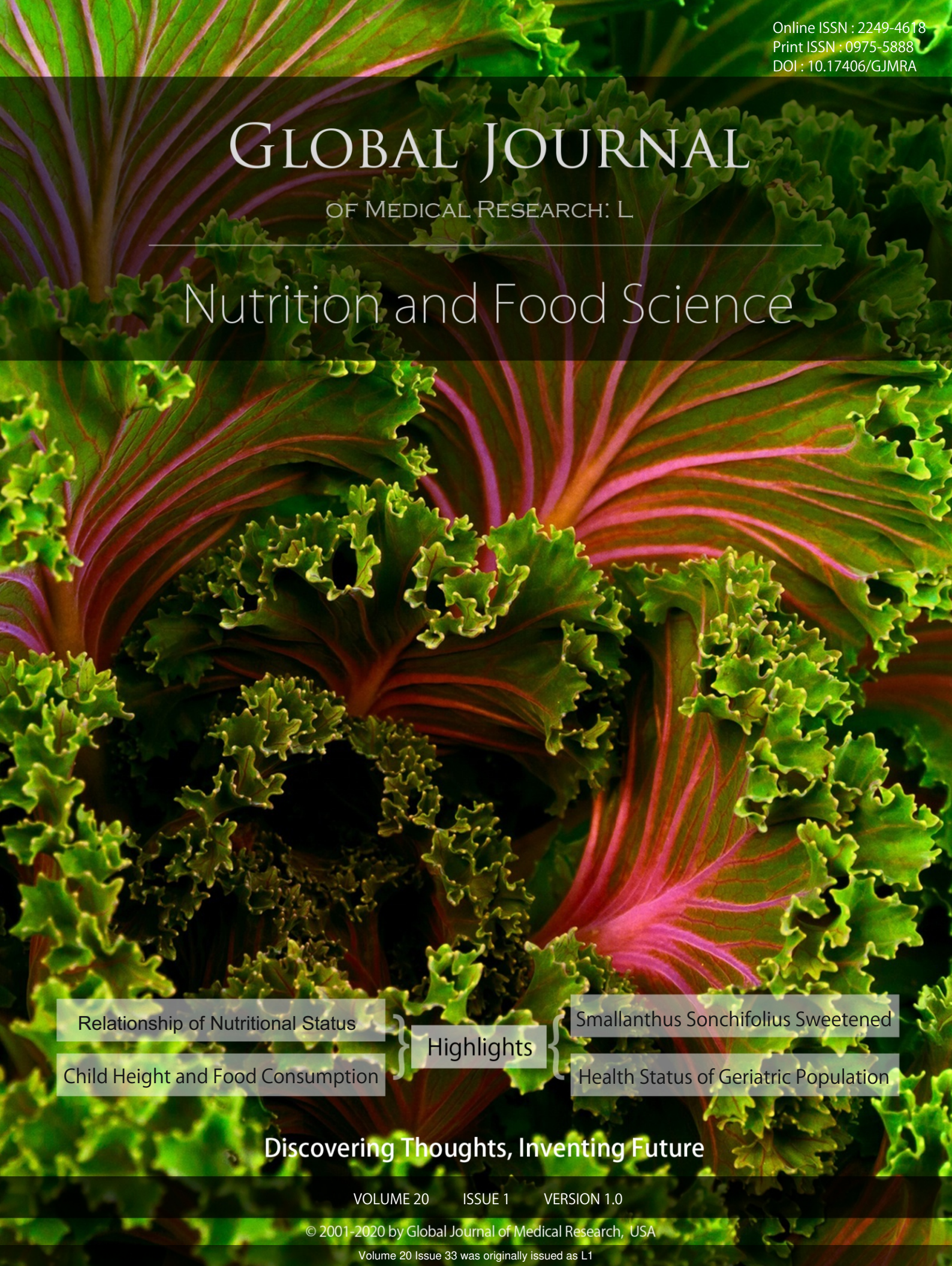
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Relationship of Nutritional Status

Child Height and Food Consumption

Highlights

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Health Status of Geriatric Population

Discovering Thoughts, Inventing Future

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Contents of the Issue

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Contents of the Issue

1. Child Height and Food Consumption in Japan in the Past Century in Comparison with South Korea: Animal Proteins and Other Essential Nutrients. *1-8*
2. Relationship of Nutritional Status and Food Consumption with the Biochemical Profile in Diabetes Mellitus Carriers of Type 2 of a Municipal Vale Do Taquari – RS. *9-21*
3. Prebiotic Beverage from *Smallanthus Sonchifolius* Sweetened with Stevia. *23-29*
4. Assessment of the Sensory Acceptability of Soy Milk based Sandesh (Traditional Indian Sweet Dairy Dessert) for Elderly People (Aged>60 Years) Living in Kolkata and its Efficacy on the Health Status of Geriatric Population. *31-38*
5. Effectiveness of Giving Cork Fish Extracts to Increasing Albumin Levels of Hypoalbumin Patients in RSUD Dr. Zainoel Abidin. *39-42*

v. Fellows
vi. Auxiliary Memberships
vii. Preferred Author Guidelines
viii. Index

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Child Height and Food Consumption in Japan in the Past Century in Comparison with South Korea: Animal Proteins and Other Essential Nutrients

By Hiroshi Mori & Sanghyo Kim

Senshu University

Abstract- Japan's economy made remarkably fast progress since the mid-1950s when it recovered to its pre-war level. Accordingly, children grew appreciably taller, as the food supply and consumption (animal protein intakes for example) increased not only in quantity but also in quality. In particular, Japanese children grew sizably in height, also in pre-war years when the supply of animal proteins was virtually zero. They ceased to grow any taller in the early 1990s, when per capita consumption of animal products, milk in particular, was still increasing at high levels. Trivial question on whether the increase in animal protein intakes contributed to body height growth in Japan is naturally raised. When examining child height development throughout the past century Japan, total food calories and other essential nutrients such as vegetables and fruit should be taken into consideration. Comparison with South Korea seems to fortify this presumption.

Keywords: animal protein, children, essential nutrients, height, Japan, South Korea.

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Child Height and Food Consumption in Japan in the Past Century in Comparison with South Korea: Animal Proteins and Other Essential Nutrients

Hiroshi Mori [α] & Sanghyo Kim [σ]

Abstract- Japan's economy made remarkably fast progress since the mid-1950s when it recovered to its pre-war level. Accordingly, children grew appreciably taller, as the food supply and consumption (animal protein intakes for example) increased not only in quantity but also in quality. In particular, Japanese children grew sizably in height, also in pre-war years when the supply of animal proteins was virtually zero. They ceased to grow any taller in the early 1990s, when per capita consumption of animal products, milk in particular, was still increasing at high levels. Trivial question on whether the increase in animal protein intakes contributed to body height growth in Japan is naturally raised. When examining child height development throughout the past century Japan, total food calories and other essential nutrients such as vegetables and fruit should be taken into consideration. Comparison with South Korea seems to fortify this presumption.

Keywords: animal protein, children, essential nutrients, height, Japan, South Korea.

I. Introduction

Japan's economy recovered to its pre-war level in the mid-1950s and made rapid and steady progress toward the end of the century. Accordingly, food consumption increased in quantity and quality, as well. Consumption of animal-sourced foods, in particular, expanded more than ten folds from the 1920s to the 1990s, e.g., per capita intake of meat +eggs was 238 kcal/day in the 1990s, compared to 13.7 kcal/day in the 1920s; per capita milk intake increased from 1.8 kcal to 139 kcal over the same period.

Children grew appreciably in height since the beginning of the century. School boys in the 6th grade in primary school, for example, grew in mean height from 129 cm in the early 1910s to 147 cm in the late 1990s, and boys in the 1st grade grew from 105.5 cm to 116 cm over the corresponding period. As far as school children are observed, they grew appreciably in height also in the pre-war years, when the net supply of animal proteins was nearly zero. On the other hand, they ceased to grow any taller in mean height in the late-1980s through the early-1990s, when per capita consumption of animal-sourced products was still gradually increasing at high levels. There exists a trivial question on whether the increase in animal protein intakes contributed to the body height development, but it may not be all for explaining changes in human height (Blum, 2013).

II. Growth in School Children in the Pre-war and the Post-war Periods

Children in Japan grew in height steadily in the pre-war years. Boys in the primary-1st grade, six years old, were 106.6 cm (in mean height) in 1907-09, and they grew to 129.2 cm in their 6th grade[1] in 1912-14, by 22.6 cm. Boys in the 1st grade were 108.7 cm in 1932-34 and grew to 132.9 in their 6th grade in 1937-39, by 24.2 cm. With the birth cohorts explicitly considered, boys grew by (108.7−106.6) + (24.2−22.6) = 3.7 cm during 30 years from 1907-09 to 1937-39. Likewise, girls in the primary-1st grade were 105.5 cm in 1907-09, and they grew to 128.8 cm in their 6th grade in 1912-14, by 23.3 cm. Girls in the 1st grade in 1932-34 were 107.5 cm, and they grew to 132.9 cm in their 6th grade in 1937-39, by 25.4cm. In pre-war years, girls grew by (107.5−105.5) + (25.4−23.3) =4.1 cm from 1907-09 to 1937-39.

After the end of WW II, August 1945, Japanese children began to grow remarkably fast and steadily toward the end of the century. Boys in the 1st grade were 108.4 cm in 1948-50[2], and they grew to 133.5 cm in their 6th grade in 1953-55, by 25.1 cm. Boys kept growing fast until the end of the 1990s. Boys in the 1st grade were 116.8 cm in 1993-95, and they grew to 145.3 cm in their 6th grade in 1998-2000, by 28.5 cm. During the half century after the war, boys in primary school grew by (116.8−108.4)+(28.5−25.1)= 11.8 cm. Likewise, girls in the 1st grade were 107.6 cm in 1948-50, and they

[1] A century ago, the rate of enrollment in middle school was quite low, regardless of sex. Those who entered middle school after graduating from primary school accounted for 12.3% in 1910 and 15.8% in 1930. Even after the end of the war, particularly girls' enrollment in high school, ages 12-17, was 38.0%, lower than 55.0% for boys in 1955, probably not high enough to represent the entire nation (Japan's Education, 1962).

[2] Those primary school children in the 1st grade in 1948-50 were born in 1942-44 and spent their "first years of life" in the severe war years (Cole, 2003; Deaton, 2007; Prentice, 2013). Per capita caloric supply soon after the war is estimated at 1,449, 1,695, and 1,851 kcal/day respectively in 1946, 47, and 48 fiscal years (starting April). The corresponding figures for the nearest pre-war years, 1937, 38, and 39, were 2,115, 2,135, and 2.075 kcal/day, respectively (Kayo, 1977).

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grew to 134.3 cm in their 6th grade in 1953-55, by 26.7 cm. Girls kept growing as fast as boys until the same peak period of the early 2000s. Girls in the 1st grade were 116.0 cm in 1993-95, and they grew to 147.1 cm in their 6th grade in 1998-2000, by 31.1 cm. During the half-century of the post-war period, Japanese girls in primary school grew by (116.0−107.6) + (31.1−26.7) = 12.8 cm.

In the pre-war years, students enrolled in middle schools should have been slightly, say 1 or 2 cm, taller in mean height than national averages for respective ages. With this reservation kept in mind, we will have a quick look at child growth from primary school 6th grade to middle school 5th grade. Boys in the primary-6th grade, 11 years old, in 1907-09 were in mean height 128.5 cm, and they grew to 157.7 cm in their 5th grade in middle school in 1912-14, by 29.2 cm. Boys in the 6th grade in 1932-34 were 131.9 cm and they grew to 160.5 cm in their 5th grade in middle school in 1937-39, by 28.6 cm. Boys grew by (131.9−128.5) + (28.6−29.2) = 2.8 cm during 30 years from 1907-09 to 1937-39.

In the post-war years, boys in the primary-6th grade were 130.7 cm in 1948-50, and they grew to their 5th grade in middle school in 1953-55, by 30.6 cm. Again, boys in the primary 6th grade in 1993-95 were 144.8 cm, and they grew to their 5th grade in middle school by 25.4 cm. After the end of the war, boys grew by (144.8−130.7) + (25.4−30.6) = 8.9 cm during the half- century. Refer to Tables 1 and 2, for more details in height development of school children in the past century (School Health Surveys).

Table 1: Changes in schoolboys' mean height by selected grades, 1980 to 2015, Japan

Unit: centimeters

	pri-1	pri-6	mid-5
2013-15	116.5	145.1	169.8
2008-10	116.7	145.1	169.9
1998-00	116.7	145.3	170.2
1993-95	116.8	144.8	170.0
1983-85	116.3	143.2	169.2
1978-80	115.7	142.7	168.6
1973-75	115.0	141.7	167.7
1953-55	109.9	133.5	161.3
1948-50	108.4	130.7	158.6
pre-war	pri-1	pri-6	mid-5
1937-39	108.7	132.9	160.5
1932-34	108.7	131.9	160.3
1922-24	107.3	130.2	158.5
1912-14	106.8	129.2	157.7
1907-09	106.6	128.5	156.9

Note: p-1 and p-6 represent primary school 1st and 6th grades and m-5 middle school 5th grade.
Source: Ministry of Education, School Health Surveys.

Table 2: Changes in schoolgirls' mean height by selected grades, 1980 to 2015, Japan

Unit: centimeters

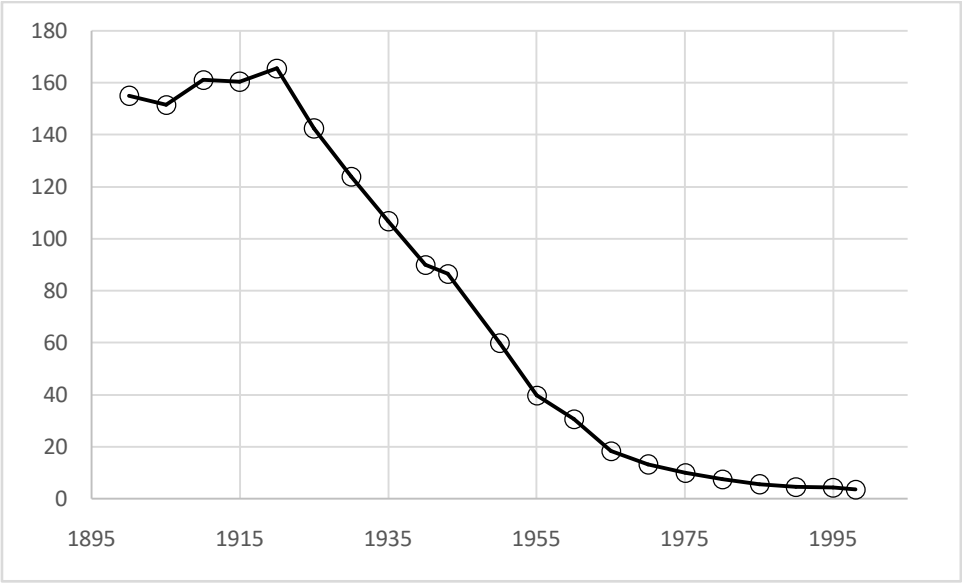
	pri-1	pri-6	mid-5
2013-15	115.5	146.8	157.6
2008-10	115.8	146.8	157.7
1998-00	115.8	147.1	157.8
1993-95	116.0	146.6	157.8
1983-85	115.6	145.4	157.4
1978-80	114.7	144.8	156.7
1973-75	114.3	143.9	156.0
1953-55	109.0	134.3	152.4
1948-50	107.6	131.2	151.5
pre-war	pri-1	pri-6	mid-5
1937-39	108.0	132.9	151.5
1932-34	107.5	132.1	151.0
1922-24	106.0	130.1	149.3
1912-14	105.3	128.8	148.3
1907-09	105.5	128.2	147.7

Note: p-1 and p-6 represent primary school 1st and 6th grades and m-5 middle school 5th grade.
Source: Ministry of Education, School Health Surveys.

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III. Changes in the Food Supply in the Past Century

"Stature is a net measure that captures the supply of inputs to health" (Steckel, 1995). About child height development, "inputs to health" should comprise mainly food consumption [=supply] and hygienic environments. In the early stages of economic development, worldwide, rates of infant mortality are found highly correlated negatively to child height growth (Rona, 2000; Reidpath, 2004). It was only after the end of the 1950s in Japan that the infant mortality began to decline appreciably: i.e., the rate was a little over 60 out of 1,000 new births at the end of the 1940s and then dropped sharply below 25 in 1959 and further down below 10 in the end of the 1980s (Figure 1) (Japanese Government, Ministry of Health and Welfare, and Minister's Secretariat, 2000). These drops in infant mortality may have contributed to the positive height development of Japanese children in the post-war period, though to what extent and through what mechanism remains to be explained by future investigations.



Source: Japanese Government, Ministry of Health and Welfare, and Minister's Secretariat (2000)

Figure 1: Changes in infant mortality, 1900 to 2000 in Japan (number of deaths out of 1,000 births)

Except for the decade long severe food shortage related to WW II, food supply in Japan increased steadily in the past century. Table 3 depicts changes in per capita food caloric supply/day by total, meat + eggs, milk, and fish for the five year-averages, 1913, 1923 and 1933 by ten year-intervals and 3 year moving averages, 1948, 1953, …, 2012 by five year-intervals. Per capita total food supply increased from 2,124 in 1913 to 2,366 in 1923 and then slightly fell to 2,256 kcal/day in 1933. On the other hand, caloric supply from animal products, meat + eggs, milk, and fish, increased appreciably over the same period before the war: caloric supply from meat and eggs, for example, increased sharply from 7.5 kcal/day in 1913 to 31.6 kcal/day in 1933 (MAFF, Basic Statistics, 1976).

Food supply increased dramatically in both quantity and quality after the end of the war. Per capita food supply recovered to the pre-war level in 1957, when per capita caloric supply from all foods was 2,242 kcal/day, while that from animal products, meat + eggs, milk, and fish, was far larger than the pre-war years: 40.9, 25.7, and 86.6 kcal, respectively in 1957. Caloric supply from all foods further increased gradually, while animal products kept increasing rapidly to unprecedented levels: Per capita caloric supply from meat + eggs, for example, increased to nearly 200 kcal/day at the end of 1970s, more than 2.5 times higher than in the early-1960, and 6 times fold than in the mid-1930s. Increases in milk supply were more dramatic: per capita supply of milk in the turn of the 1970s was 100 kcal/day, as compared to 2.6 kcal/day in the mid-1930s (Kayo; MAFF, 1976). Increases in the supply of animal-sourced products slowed down in speed since then but per capita caloric supply from meat + eggs, milk and fish was 237.8, 162.2 and 139.8 kcal/day, respectively, at the end of 1990s (MAFF, Food Balance Sheets).

Rapid and steady increases in animal-sourced proteins contributed to considerable growth in child height. There exists a little question about this[3] (Baten and Blum, 2014; Heady, Hirvonen and Hoddinott, 2018).

[3] When mean height of boys in the primary 6th grade regressed against per capita supply of total foods and animal sourced foods (meat + eggs, milk, and fish) from 1913 to 2012:
ln(Hp6) = 4.269 +0.060 ln(total foods) + 0.037ln(animal foods)
Adj R^2 = 0.962 (20.2) (2.09) (11.78)
where numbers in parentheses are t-statistics.

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When height growth overtime examined visually, however, straight linearity between animal protein supply and child height may require careful reservations. First, the Japanese did not consume a meaningful amount of animal-sourced foods before the war, but children had grown steadily in height. Japanese children ceased to grow in height in and around 1990, whereas the per capita supply of animal products still kept increasing considerably. Particularly, the per capita caloric supply of milk increased from 117.3 kcal/day in 1987 to 149.8 in 1992 and 162.4 kcal in 2002, respectively (Table 3).

Table 3: Changes in per capita daily caloric supply by sources in the past century, Japan

Unit: kcal/day

	Total Calorie	From Meat and Egg	From Milk	From Fish	From Animal Products
2012	2433.0	242.5	155.3	105.1	502.9
2007	2512.4	236.2	158.2	125.3	519.7
2002	2594.9	236.7	162.4	137.2	536.3
1997	2634.8	237.8	162.2	139.8	539.8
1992	2632.6	229.7	149.8	140.6	520.1
1987	2580.2	215.5	117.3	132.9	465.7
1982	2566.4	208.0	112.4	131.1	451.5
1977	2546.3	187.1	98.7	126.8	412.6
1973	2547.0	163.3	87.1	111.0	361.4
1972	2490.8	153.9	83.2	96.3	333.4
1967	2434.6	110.8	69.5	90.6	270.9
1962	2357.0	77.5	46.5	89.2	213.2
1957	2241.7	40.9	25.7	86.6	153.2
1953	1934.3	26.3	13.7	56.9	96.9
1948	1773.4	7.4	5.4	47.6	60.4
1933	2256.2	31.6	2.6	36.7	70.9
1923	2365.8	13.7	1.8	28.9	44.4
1913	2124.4	7.5	0.9	13.2	21.6

Note: numbers in this table depicts 3-year moving averages for each year, for example, the value for 1913 is average of 1912 through 1914.

Source: Ministry of Agriculture, Food Balance Sheets; Basic Statistics, 1976.

International comparisons might be of some relevance. South Korean teens, genetically very close nation (Kim, 1982), were slightly, 0.5-1.0 cm, shorter in mean height than their Japanese peers in 1985-90 and the same in the mid-1990s but overtook their Japanese peers by 2-3 cm in the mid-2000s (Table 4) (Rep. Korea, School Health Surveys). Per capita net supply of meat + eggs and milk increased from 47.6 and 49.5 kg, respectively, in 1995 to 59.9 and 56.9 kg, respectively in 2005 in S. Korea (FAOSTAT, Food Balance Sheets), as compared to 65.9 and 80.8 kg, respectively in 2005 in Japan. As the 1990s through the mid-2000s is known as the period of "qualitative expansion of food consumption" (Lee, et al., 2016), the reversal of body height of teens between the two nations can be attributed to the overall improvement of food consumption in Korea. When considering the statistical fact that Japan's per capita consumption of particularly milk has been substantially greater than in Korea in the latest decades, why Koreans became taller than Japanese remains a conundrum.[4] We will discuss this in the subsequent section.

[4] Per capita supply of meat + eggs and milk in South Korea increased from 127.3 and 147.7 g/day, respectively, in 2005 to 146.7 and 154.4 g/day in 2010 and 177.8 and 173.1 g/day, respectively in 2015 (KREI, Food Balance Sheets). High school male seniors, however, did not increase in mean height any longer since the mid-2000s: i.e., 173.7 cm in 2005, 173.7 cm in 2010, and 173.5 cm in 2015, respectively (School Health Surveys). All years represent three year moving averages, e.g., 2010=average (2009:2011).

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Table 4: Changes in mean height of boys in high school in Japan and South Korea, 1980 to 2010

Unit: centimeter

Japanese boys							
grades	1980	1985	1990	1995	2000	2005	2010
1st	167.0	167.5	167.9	168.4	168.6	168.4	168.3
3rd	169.6	170.2	170.5	170.9	170.9	170.8	170.7
Korean boys							
grades	1980	1985	1990	1995	2000	2005	2010
1st	164.4	165.5	166.3	168.3	170.5	171.6	171.8
3rd	168.4	169.4	169.7	171.0	172.9	173.7	173.7

Source: Ministry of Education, School Health Surveys, various issues

IV. Total Calories and Essential Nutrients other than Animal Proteins in Increasing Body Height

Teens in the early 2000s were born in the late 1980s through the early 1990s. What young children ate in the late 1980s to early 1990s and the mid-teens consumed in the late 1990s should have contributed to determining increments in body height of late adolescents seen around the mid-2000s. As stated earlier and shown in Table 6 (FAOSTAT), the Japanese exceeded South Koreans substantially in respect of per capita net supply of animal products over the decades from 1980 through 2010. On the other hand, South Koreans, on average, took approximately 300 kcal greater food calories (Table 6), 30-40% more fruit and nearly twice more vegetables (excluding potatoes) than Japanese (Table 5). On the assumption that the Japanese and the Koreans are very close in ethnical endowments in body height (Kim, 1982), the widened differences in mean height of teens between the two nations could be attributed to differences in "inputs to health"(Steckel, 1995) observed in the recent years.

Japanese, consuming appreciably fewer total food calories with substantially less fruit and half as much vegetables than South Koreans, could be biologically shorter in height than South Koreans. One should be reminded of the statistical fact that the newer generations in Japan have increasingly steered away from fruit and vegetables since the mid-1970s (Tables 7-8), whereas their Korean peers have been consuming almost as much fruit and vegetables as the older generations (FIES; MAFF, White Paper, 1995; Park, 2018).

Table 5: Changes in per capita supply of meat & eggs, milk, vegetables and fruit in Japan and South Korea, 1980 to 2010

Unit: kg/year

Meat & Egg	Japan	Korea	Milk*	Japan	Korea
1980	46.7	19.7	1980	74.9	13.1
1985	50.8	25.5	1985	80.3	26.0
1990	57.3	33.7	1990	83.4	42.0
1995	63.9	47.6	1995	87.5	49.5
2000	64.8	57.3	2000	85.2	55.6
2005	65.9	59.9	2005	80.8	56.9
2010	66.7	70.1	2010	74.7	54.0
Fruit	**Japan**	**Korea**	**Vegetable**	**Japan**	**Korea**
1980	55.6	23.2	1980	122.6	197.9
1985	51.9	35.2	1985	119.5	181.7
1990	50.2	47.0	1990	116.7	200.6
1995	53.2	59.6	1995	116.6	222.3
2000	51.4	69.6	2000	112.8	235.7
2005	60.3	76.1	2005	107.8	215.8
2010	49.1	67.6	2010	98.9	196.5

*Note: * per capita net supply of milk is abnormally under-calculated for only South Korea for unknown reasons.*

Total domestic supply of milk in1,000 tons are divided by total population, both provided in FAOSTAT, to recalculate per capita supply of milk, both countries.

Source: FAOSTAT, Food Balance Sheets.

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Table 6: Changes in per capita caloric supply, total foods and animal products in Japan and S. Korea, 1980 to 2010

Unit: kcal/day

	Data from FAOSTAT				MAFF	KREI
		Japan	Korea		Japan	Korea
	year	kcal/day	kcal/day	year	kcal/day	kcal/day
Total calories	1980	2785	3046	1980	2561	2539
	1985	2854	2982	1985	2599	2681
	1990	2950	2990	1990	2637	2858
	1995	2938	3021	1995	2657	2960
	2000	2895	3090	2000	2632	2952
	2005	2816	3104	2005	2562	2977
	2010	2691	3279	2010	2440	2851
Calories from Animal Products	1980	539	230	1980	443	233
	1985	577	275	1985	463	307
	1990	618	317	1990	508	374
	1995	624	411	1995	546	437
	2000	600	449	2000	541	452
	2005	578	475	2005	529	463
	2010	549	545	2010	504	488

Note: numbers in this table depicts 3-year moving averages for each year, for example, the value for 1913 is average of 1912 through 1914.
Source: FAOSTAT, Food Balance Sheet; MAFF for Japan and KREI for Korea

Table 7: Changes in per capita at-home consumption of fresh vegetables by age groups, 1971 to 2010 in Japan

Unit: kg/year

age/year	1971	1980	1985-86	1990	1995-96	2000	2010
0~9 yr	44.8	33.7	27.3	23.0	20.2	18.3	17.5
10~19	62.2	51.1	44.7	38.8	36.0	30.0	30.6
20~29	67.8	56.1	52.5	45.5	46.2	40.8	37.6
30~39	68.5	65.6	60.2	54.3	52.3	49.8	45.5
40~49	77.4	80.3	78.2	71.7	67.3	62.0	54.7
59~59	89.0	90.5	91.9	84.0	83.7	82.3	66.2
60~69	87.5	93.3	99.0	91.2	91.0	94.0	80.8
70~	71.0	80.0	89.4	80.1	81.3	86.9	81.5
Average	67.1	63.6	62.4	58.3	59.0	57.2	55.4

Note: estimated by 5 year intervals first, which were simply averaged into 10 year intervals
Source: derived from FIES by the authors using TMI model

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Table 8: Changes in per capita at-home consumption of fresh fruit by age groups, 1971 to 2010 in Japan

Unit: kg/year

age/year	1971	1980	1985-86	1990	1995-96	2000	2010
0~9 yr	36.3	26.5	15.2	8.9	4.7	2.3	2.4
10~19	45.6	30.5	20.1	14.9	9.4	5.7	4.4
20~29	48.3	31.5	23.4	16.8	15.1	11.8	9.8
30~39	46.1	43.8	36.6	30.4	23.6	21.8	14.8
40~49	51.0	52.6	48.5	44.9	37.2	33.4	20.5
59~59	54.4	59.9	56.6	54.0	50.5	48.5	32.1
60~69	44.5	58.5	61.1	62.0	58.7	60.7	53.3
70~	41.2	54.2	59.6	60.3	62.1	65.8	58.8
Average	45.6	41.6	36.4	33.8	31.5	31.1	27.7

Note: the same as Table 7.
Source: the same as Table 7.

V. Conclusions

In the past century, children in Japan grew taller by over 10 cm. Japan's economy made steady progress, and food consumption improved immensely. Changes in child height, however, should not be linearly attributed to the consumption of animal proteins. By casual observations, if parents or either one of them are tall, children should be tall, unless they are not fed proper nutrition throughout childhood, and the opposite might be the case. Nutritionally, however, a possible importance of vegetables and fruit in supporting children's physical growth (Vatanparast et al., 2005; Prynne et al., 2006) as "essential nutrients" may require due considerations, empirically and biologically.

Humans do not grow appreciably taller after their mid-teens, boys at 16-17 and girls at 14-15, should they eat greater amounts of animal proteins afterword. In the society, where distinct age/cohort effects are present in food consumption, per capita consumption by age groups, in place of nation's simple per capita consumption, may require due attention to identify underlining food contributions for child growth in height over the perod or between populations (Mori, Inaba, and Dyck, 2016; Mori and Inaba, 1997; Tanaka et al., 2004; Mori, 2020).

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Relationship of Nutritional Status and Food Consumption with the Biochemical Profile in Diabetes Mellitus Carriers of Type 2 of a Municipal Vale Do Taquari – RS

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Abstract- This study aimed to relate the nutritional status and food consumption with the biochemical profile of patients with type 2 diabetes mellitus (DM2), who attended Health Education groups promoted by a Basic Health Unit in the city of Rio Grande do Sul, Brazil. Quantitative, cross-sectional study, with a sample of 74 adult and elderly individuals. Data collection corresponded to the measurement of anthropometric measurements of weight and height, waist circumference (WC, arm circumference (CB), neck circumference (CP), tricipital skin fold (PCT) and subscapular skin (PCS), application of a 24-hour food record, referring to a day of the week and a food record of a day of the weekend, and biochemical data of the blood.

Keywords: *diabetes mellitus. nutritional assessment. health center.*

GJMR-L Classification: *NLMC Code: WB 400*



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Relationship of Nutritional Status and Food Consumption with the Biochemical Profile in Diabetes Mellitus Carriers of Type 2 of a Municipal Vale Do Taquari – RS

Relação Entre Estado Nutricional E Consumo Alimentar Com O Perfil Bioquímico De Portadores De Diabetes Mellitus Do Tipo 2 De Um Município Do Vale Do Taquari – RS, Brasil

Naira Denise Wahlbrinck [α], Fernanda Scherer Adami [σ] & Patricia Fassina [ρ]

Resumo- O estudo objetivou relacionar o estado nutricional e o consumo alimentar com o perfil bioquímico de portadores de diabetes mellitus do tipo 2 (DM2), que frequentavam os grupos de Educação em Saúde promovidos por uma Unidade Básica de Saúde de município do Rio Grande do Sul, Brasil. Estudo quantitativo, de corte transversal, com amostra de 74 indivíduos adultos e idosos. A coleta dos dados correspondeu à aferição de medidas antropométricas de peso e altura, circunferência da cintura (CC, circunferência do braço (CB), circunferência do pescoço (CP), prega cutânea tricipital (PCT) e subescapular (PCS), aplicação de um recordatório alimentar de 24 horas, referente a um dia da semana e um registro alimentar de um dia do final de semana, e dados bioquímicos do sangue. Foi possível observar que na relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela com PCT e PSC os indivíduos em desnutrição energética consumiam quantidades significativamente superiores de carboidrato (p=0,024) e possuíam taxa de triglicerídeos significativamente inferior (p=0,028). Na relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela PSC os indivíduos eutróficos apresentaram hemoglobina glicada (HG) significativamente inferior (p=0,023), sendo a taxa de colesterol HDL significativamente inferior para indivíduos em sobrepeso/obesidade (p=0,030), apesar de valores significativamente superiores de triglicerídeos para estes mesmos indivíduos (p=0,021). Ainda, o consumo alimentar e o perfil bioquímico sanguíneo relacionados ao risco cardiovascular (RCV) pela CP demonstraram que indivíduos com RCV consumiam quantidade significativamente maior de fibras (p=0,050), possuindo taxa de HG significativamente superior (p=0,033). Já a relação entre o consumo alimentar e o perfil bioquímico sanguíneo com o RCV pela CC revelou que indivíduos com baixo RCV consumiam significativamente menor teor de carboidrato (p = 0,018). Conclui-se que existe relação entre estado nutricional, consumo alimentar e níveis bioquímicos de sangue entre os indivíduos com DM2.

Palavras-chave: diabetes mellitus. avaliação nutricional. unidade básica de saúde.

Abstract- This study aimed to relate the nutritional status and food consumption with the biochemical profile of patients with type 2 diabetes mellitus (DM2), who attended Health Education groups promoted by a Basic Health Unit in the city of Rio Grande do Sul, Brazil. Quantitative, cross-sectional study, with a sample of 74 adult and elderly individuals. Data collection corresponded to the measurement of anthropometric measurements of weight and height, waist circumference (WC, arm circumference (CB), neck circumference (CP), tricipital skin fold (PCT) and subscapular skin (PCS), application of a 24-hour food record, referring to a day of the week and a food record of a day of the weekend, and biochemical data of the blood. It was possible to observe that in the relationship of food consumption and blood biochemical profile with nutritional status by PCT and PSC, individuals with energy malnutrition consumed significantly higher amounts of carbohydrate (p = 0.024) and had a significantly lower triglyceride rate (p = 0.028) .In relation to food consumption and blood biochemical profile with the nutritional status by PSC eutrophic patients had significantly lower glycated hemoglobin (HG) (p = 0.023), with the HDL cholesterol lower for overweight / obese individuals (p = 0.030), despite significantly higher triglyceride values for these same individuals (p = 0.021). Still, food consumption and blood biochemical profile related to cardiovascular risk (CVR) by CP demonstrated that individuals with CVD consumed a significantly higher amount of fibers (p = 0.050), having a significantly higher HG rate (p = 0.033). The relationship between food consumption and blood biochemical profile with CVR by CC revealed that individuals with low CVR consumed significantly less carbohydrate content (p = 0.018). It is concluded that there is a relationship between nutritional status, food consumption and biochemical blood levels among individuals with DM2.

Keywords: diabetes mellitus. nutritional assessment. health center.

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I. Introdução

O diabetes mellitus (DM) é uma doença caracterizada por apresentar deficiência na produção de insulina pelas células pancreáticas e, como consequência, manter elevados os níveis de glicose no sangue, envolvendo fatores genéticos, ambientais e hormonais.[1] É uma patologia frequente em todo mundo e um dos mais relevantes problemas de saúde pública, não só pela sua elevada prevalência, mas por apresentar complicações crônicas e alto índice de mortalidade.[2] O diabetes mellitus do tipo 2 (DM2) é o mais comum entre os tipos de DM e corresponde a aproximadamente 90 a 95% de todos os casos.[3]

Com o aumento dos casos de DM2, esta enfermidade vem sendo considerada uma epidemia global. Atualmente, o número de diabéticos, no mundo, é de 415 milhões e estima-se que, em 2040, este número poderá chegar aos 642 milhões.[4] Tal crescimento está relacionado a diversos fatores, como o envelhecimento da população, a diminuição da atividade física, a adoção de aspectos comportamentais não saudáveis, a modificação dos hábitos alimentares, ao estado nutricional, sendo o excesso de peso e a obesidade um dos principais fatores que contribui para o desenvolvimento do DM2, além da hipertensão arterial sistêmica (HAS).[5,6]

O envelhecimento humano traz consigo alguns processos degenerativos considerados normais[7], sendo o DM2 uma das doenças crônicas que mais acomete a população idosa no Brasil.[8] Os processos degenerativos fisiológicos são vistos no pâncreas, na glândula secretora de insulina, que sofre importante mudança estrutural, como redução de massa e estreitamento dos ductos, que provocam uma redução da secreção de insulina, o que explica a redução da sensibilidade periférica a esse hormônio.[9] Esta é representada por uma maior resistência na percepção da insulina endógena, gerando uma hiperglicemia provocada por falha na captação desse hormônio para dentro das células.[10] Assim, os idosos apresentam maior suscetibilidade a DM2.[9]

Em relação à adoção de práticas comportamentais não saudáveis, no Brasil, a modificação do perfil da população em relação à adesão de estilos de vida pouco saudáveis e ao alto consumo de alimentos industrializados, contribuíram para o aumento na incidência e na prevalência da DM2.[11] Em vista disso, é importante que o portador de DM2 mantenha uma rotina de realização de exames bioquímicos cabendo ainda ressaltar que existem diversas vantagens em se realizar o monitoramento do perfil bioquímico, como manter o controle dos alimentos ingeridos, prevenir possíveis complicações da doença, bem como evitar a hipoglicemia.[12]

Devido às diversas complicações e à alta prevalência de comorbidades provenientes do diabetes, tem-se a necessidade de realizar intervenções direcionadas à educação em saúde assim como ações terapêuticas para a adoção de hábitos de vida alimentares saudáveis, melhorando assim as condições de saúde dos indivíduos diabéticos e o controle da doença.[13,14] O tratamento do DM2 é complexo e para alcançar o controle glicêmico e prevenir complicações o indivíduo deve aderir a modificações comportamentais e participar ativamente no plano de cuidados.[15]

A educação do paciente pode ser exercida por meio de diferentes estratégias com o objetivo de melhorar seus resultados[15], sendo a educação nutricional um fator de extrema importância na melhora dos sintomas e prevenção da progressão desta doença. Esta serve para que o paciente diabético tenha consciência sobre o cuidado com esta enfermidade, pois envolve tanto o paciente diabético e quanto o profissional da área da saúde de forma interativa com base no desenvolvimento, na orientação, na equidade juntamente com a participação do indivíduo, familiares e comunidade.[16]

Tendo em vista o já exposto, este estudo buscou relacionar o estado nutricional e o consumo alimentar com o perfil bioquímico de portadores de DM2 que frequentavam os grupos de Educação em Saúde promovidos pela Unidade Básica de Saúde (UBS) de um município do Rio Grande do Sul, Brasil.

II. Métodos

Trata-se de um estudo quantitativo, de corte transversal, que avaliou 74 indivíduos adultos e idosos, de ambos os sexos, com diagnóstico de DM2, que frequentaram os grupos de Educação em Saúde de uma UBS entre os meses de agosto de 2017 a janeiro de 2018, nos salões das comunidades de um município do Vale do Taquari, Rio Grande do Sul, Brasil.

Os critérios de inclusão consideraram possuir idade superior a 20 anos, frequentar os grupos de Educação em Saúde, apresentar diagnóstico de DM2 e aceitar participar da pesquisa por meio do preenchimento do Termo de Consentimento Livre e Esclarecido (TCLE). Os critérios de exclusão consideraram desistência em participar da pesquisa, indivíduo analfabeto e/ou com déficit de compreensão.

Os instrumentos utilizados para a coleta de dados corresponderam à aferição de medidas antropométricas, aplicação de um recordatório alimentar de 24 horas (RA24h) referente ao dia anterior à coleta de dados e um registro alimentar de um dia do final de semana (sábado ou domingo), além da verificação do nível de pressão arterial (PA) e dos dados dos exames bioquímicos.

A avaliação antropométrica foi realizada através da aferição de peso e da estatura para o cálculo do Índice de Massa Corporal (IMC), medida da circunferência da cintura (CC), circunferência do

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pescoço (CP), medida da circunferência braquial (CB), prega cutânea tricipital (PCT) e prega subescapular (PSC).

Para aferição do peso, foi utilizada uma balança digital portátil da marca G-Tech®, com graduação de 100g e capacidade máxima de 150 kg. O avaliado foi posicionado no centro da balança, descalço, com o mínimo de roupa possível, ereto com os pés juntos e os braços estendidos ao longo do corpo, mantendo-se nessa posição, até que a leitura fosse realizada.[17]

A medida da altura foi aferida em posição ortostática, com utilização do estadiômetro portátil da marca Sanny Profissional®, com precisão de 0,1cm e extensão máxima de dois metros, estando o indivíduo descalço, com a cabeça livre de adereços, ereto, com os braços estendidos ao longo do corpo, as pernas paralelas formando um ângulo reto com os pés e a cabeça erguida, olhando para um ponto fixo na altura dos olhos, posicionada no plano de Frankfurt.[17]

A partir dos dados de peso e altura, foi realizado o cálculo de IMC com classificação, para adultos, conforme a Organização Mundial da Saúde[18] e, para idosos, de acordo com a Organização Pan-Americana da Saúde.[19]

A verificação da medida da circunferência da cintura (CC) foi realizada com o indivíduo em pé, utilizando uma fita métrica não extensível, da marca Cardiomed®. Para a tomada da medida, a fita circundou o indivíduo no ponto médio entre a última costela e a crista ilíaca, sendo a leitura feita no momento da expiração, conforme o Protocolo International Standards for Anthropometric Assesment (ISAK).[20] A avaliação do risco cardiovascular (RCV), conforme a circunferência da cintura foi embasada segundo a classificação da OMS.[21]

Para a medida da CP foi utilizada uma fita métrica não extensível, da marca Cardiomed®. Para tanto indivíduo deve estar em pé, manter a cabeça no plano de Frankfurt e a fita deverá circundar no perímetro do pescoço na região superior à glândula tireoide. Em homens com proeminência, a CP deve ser aferida abaixo da mesma tomando cuidado para não apertá-la, conforme o Protocolo ISAK.[20] Foram classificados com elevado RCV quando CP $\geq$37cm par a homens e $\geq$34cm para mulheres.[22]

Para a obtenção da medida da CB, foi utilizada uma fita métrica não extensível, da marca Cardiomed®. O indivíduo posicionou-se em pé, com o braço direito flexionado formando um ângulo de 90 graus para marcar o ponto médio entre o acrômio e a fossa ulnar. Após, relaxou o braço ao longo do corpo e manter a palma da mão voltada para a coxa. Para a verificação da medida a fita circundou o ponto médio marcado evitando compressão ou folga da pele, conforme o Protocolo ISAK.[20]

Para a classificação do estado nutricional pela CB, o valor do resultado obtido através desta medida foi comparado aos valores de referência demonstrados em tabelas de percentis por Frisancho.[23] Posteriormente, foi efetuado o cálculo da adequação da CB para classificação do estado nutricional de acordo com Blackburn e Thornton.[24]

Para determinar a medida da PCT e da PSC, o participante ficou em pé, com a quantidade mínima de roupa possível, com a pele seca e sem loção. Para a aferição das medidas foi utilizado um adipômetro da marca Cescorf®. A medida da PCT foi realizada no braço direito do indivíduo, o qual manteve o braço flexionado em direção ao tórax, formando um ângulo de 90 graus. Logo após foi marcado o ponto médio entre o acrômio e a fossa ulnar, em seguida o braço manteve-se relaxado ao longo do corpo. Com os dedos polegar e indicador da mão livre, o avaliador segurou a dobra formada por pele e tecido adiposo, aproximadamente um centímetro acima do ponto médio marcado e realizou a leitura exatamente sobre o ponto marcado.

A aferição da PSC foi tomada a dois centímetros abaixo do ângulo inferior da escápula, à direita. Para marcar o ponto de medida o braço do indivíduo se manteve flexionado sobre as costas. Para realização da leitura, o indivíduo manteve o braço e ombros relaxados e, em seguida, o avaliador segurou a dobra um cm abaixo do ângulo inferior da escápula e realizou a leitura exatamente sobre o ponto marcado. Tanto na obtenção da leitura da PCT, como na PSC o registro da medição foi realizado no tempo de dois segundos, após ter aplicado toda a pressão do adipômetro no ponto marcado na pele conforme o Protocolo ISAK.[20]

Para a classificação do estado nutricional pela PCT e PSC, o valor do resultado obtido através de cada medida foi comparado aos valores de referência demonstrados em tabelas de percentis por Frisancho.[23] Posteriormente, foi efetuado o cálculo da adequação da PCT e PSC para classificação do estado nutricional de acordo com Blackburn e Thornton.[24]

Para a avaliação do consumo alimentar por meio do RA24h referente ao dia anterior à coleta de dados e do registro alimentar de um dia do final de semana (sábado ou domingo), os indivíduos foram questionados e orientados a preencher o instrumento de consumo alimentar quanto a quantidade de alimentos, em medidas caseiras, como por exemplo, copo, fatias, colheres de sopa, concha, colher de servir. No caso de frutas, verduras, bolo ou alimentos em que a medida seria em unidade, a quantidade foi informada em pedaço pequeno, médio ou grande, de forma a tentar registrar da forma mais fidedigna possível a quantidade em medida caseira na qual os alimentos foram ingeridos.

Os dados coletados sobre o consumo alimentar foram calculados no software Dietwin® (2011)

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e comparados as diretrizes da Sociedade Brasileira de Diabetes,[16] para avaliação dos seguintes nutrientes: valor energético total (VET), carboidrato, proteína, lipídeo, colesterol, sódio, fibras e potássio. Para avaliar o registro alimentar foi calculada a média aritmética dos dois dias para todos os nutrientes referidos.

A aferição da PA foi realizada pelo enfermeiro da equipe multidisciplinar que esteve presente nos grupos de Educação em Saúde. O indivíduo permaneceu em repouso durante 5 minutos antes de ser aferida a PA, que foi realizada com um esfigmomanômetro e estetoscópio portátil da marca Premiun® e foi instruído a não conversar durante a medida, devendo estar na posição sentado, pernas descruzadas, pés apoiados no chão, dorso recostado na cadeira e relaxado. O braço deveria estar na altura do coração, livre de roupas, apoiado, com a palma da mão voltada para cima e o cotovelo ligeiramente fletido. Dentre os níveis estabelecidos a pressão sistólica deve ser menor que 130mmHg e a diastólica menor que 85mmHg. [25]

Os indivíduos diabéticos foram orientados a levar seus exames bioquímicos referentes aos últimos seis meses no dia em que participaram do grupo de Educação em Saúde. Foram solicitados e analisados os exames de glicemia em jejum (GJ), hemoglobina glicada (HG), colesterol total (CT), lipoproteínas de alta intensidade (HDL – *High Density Lipoprotein*), lipoproteínas de baixa intensidade (LDL – *Low Density Liporotein*) e triglicerídeos (TG). Foram considerados como normalidade para a GJ os valores de referência entre 70 a 99 miligramas de glicose por decilitro de sangue (mg/dL), Colesterol total (CT): inferior a 190 mg/dL, LDL-colesterol: inferior a 100 mg/d, HDL-colesterol: superior a 60 mg, TG: inferior a 150 mg/dL. O diagnóstico de diabetes no plasma venoso foi realizado pela GJ: ≥126 mg/dl ou ≥7,0 mmol/ l. Para a HG os valores referência considerados foram entre 4,5% e 5,7%; anormal próximo do limite (pré-diabetes): 5,7% e 6,4% e consistente para diabetes: maior ou igual a 6,5%.[16,26]

Os dados foram analisados através de tabelas, gráficos, estatística descritiva (médias e desvios-padrão) e pelos testes estatísticos: teste não-paramétrico Mann-Whitney, teste não-paramétrico Kruska-Wallis e teste de associação Exato de Fisher. Os resultados foram considerados significativos a um nível de significância máximo de 5% ($p \leq 0,05$). O software utilizado para a análise estatística foi o Statistical Package for the Social Sciences (SPSS) versão 22.0.

O projeto foi aprovado pelo Comitê de Ética em Pesquisa da Universidade de Vale do Taquari (COEP) pelo parecer de nº 2.187.463.

III. Resultados

Na Tabela 1 foi possível observar que a maioria dos indivíduos estudados, 56,8% (n=42), referiu-se ao sexo feminino. A maioria apresentou mais de 70 anos, 35,1% (n=26), seguido pela faixa etária de 60 a 70 anos, 33,8% (n=25). Em relação ao estado nutricional representado pelo IMC, maior parcela da população estudada, 67,6% (n=50), apresentou excesso de peso. Quanto à circunferência do braço (CB), um pouco mais da metade dos indivíduos, 55,4% (n=41), apresentou eutrofia. Sobre a prega cutânea tricipital (PCT) a maioria, 43,3% (n=32), apresentou algum grau de desnutrição em relação ao tecido adiposo, referindo baixa reserva de gordura corporal, e referente a prega cutânea subescapular (PSC) a maioria, 48,7% (n=36), estava em excesso de peso. Para a circunferência do pescoço (CP), a maioria, 94,6% (n=36), apresentou risco cardiovascular (RCV) enquanto que, para a circunferência da cintura (CC), 79,7% (n=59), apresentaram risco muito elevado para o desenvolvimento de doença cardiovascular.

Constatou-se também que a metade dos indivíduos avaliados, 50% (n=37), possuía glicemia de jejum (GJ) descompensada e que a maioria, 64,9% (n=48), estava com hemoglobina glicada (HG) também descompensada. Já, a maior parte da população estudada apresentou valores controlados para colesterol total (CT) (66,2%; n=49), bem como para níveis de lipoproteínas de alta intensidade (HDL – *High Density Lipoprotein*) (52,7%; n=39), lipoproteínas de baixa intensidade (LDL – *Low Density Liporotein*) (54,1%; n=40), triglicerídeos (TG) (75,7%; n=56) e pressão arterial (PA) (73,0%; n=54).

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Tabela 1: Descrição da amostra investigada e perfil bioquímico sanguíneo conforme os padrões de referência

Variável	Categoria	Nº casos	%
Sexo	Feminino	42	56,8
	Masculino	32	43,2
Idade	Menos de 60 anos	23	31,1
	60 - 70 anos	25	33,8
	Mais de 70 anos	26	35,1
Classificação IMC	Baixo peso	4	5,4
	Peso Normal	20	27,0
	Sobrepeso	11	14,9
	Obesidade	39	52,7
Classificação CC	Baixo RCV	7	9,5
	RCV elevado	8	10,8
	RCV muito elevado	59	79,7
Classificação CB	Desnutrição energética leve	7	9,5
	Eutrofia	41	55,4
	Sobrepeso	11	14,9
	Obesidade	15	20,3
Classificação PCT	Desnutrição energética grave	8	10,8
	Desnutrição energética moderada	13	17,6
	Desnutrição energética leve	11	14,9
	Eutrofia	17	23,0
	Sobrepeso	3	4,1
	Obesidade	22	29,7
Classificação PSC	Desnutrição energética grave	9	12,2
	Desnutrição energética moderada	4	5,4
	Desnutrição energética leve	7	9,5
	Eutrofia	18	24,3
	Sobrepeso	5	6,8
	Obesidade	31	41,9
Classificação CP	Baixo RCV	4	5,4
	Com RCV	70	94,6
Glicemia Jejum	Compensado	37	50,0
	Descompensado	37	50,0
Hemoglobina Glicada	Compensado	26	35,1
	Descompensado	48	64,9
Colesterol Total	Compensado	49	66,2
	Descompensado	25	33,8
HDL	Compensado	39	52,7
	Descompensado	35	47,3
LDL	Compensado	40	54,1
	Descompensado	34	45,9
Triglicerídeos	Compensado	56	75,7
	Descompensado	18	24,3
Pressão Arterial	Normal	54	73,0
	Alterado	20	27,0

IMC: Índice de Massa Corporal
CC: Circunferência da Cintura
CB: Circunferência do Braço
PCT: Prega Cutânea Tricipital
PSC: Prega Subescapular
CP: Circunferência do Pescoço
RCV: Risco Cardiovascular
HDL: *High Density Lipoprotein*
LDL: *Low Density Liporotein*

O consumo alimentar da amostra investigada apresentou valor energético total (VET) médio de 1277,7±464,0 kcal, sendo 30,5±12,7% de carboidratos (CH), 13,8±5,7% de proteínas (PTN) e 20,2 ±7,7% de lipídios (LIP); além de 242,1±121,5 mg de colesterol; 18,1±5,9 g de fibras; 1346,9±715,0 mg de sódio e 1.444,6±523,2 mg de potássio.

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O perfil bioquímico sanguíneo apresentou GJ com média de 144,8±62,7 mg/dL; HG com 7,9 ±1,6%; CT com 184,2±38,4 mg/dL; HDL com 62,0±16,4 mg/dL; LDL com 96,4±35,6 mg/dL e TG com 132,3±53,9 mg/dL.

Quanto a relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela com PCT foi observado que os indivíduos em estado de desnutrição energética consumiam quantidades significativamente superiores de CH, com média de 34,6±13,7%, (p=0,024) e possuíam uma taxa de TG significativamente inferior, com média de 117,3±56,5 mg/dL (p=0,028) (Tabela 2).

Tabela 2: Relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela prega cutânea tricipital

Variável	PCT	n	Média	Desvio Padrão	P
VET (kcal)	Desnutrição energética	32	1351,7	505,3	0,550
	Eutrofia	17	1135,9	388,3	
	Sobrepeso/Obesidade	25	1279,4	450,4	
CH (%)	Desnutrição energética	32	34,6	13,7	0,024
	Eutrofia	17	29,1	12,5	
	Sobrepeso/Obesidade	25	26,3	10,2	
PTN (%)	Desnutrição energética	32	14,7	5,9	0,269
	Eutrofia	17	11,8	4,7	
	Sobrepeso/Obesidade	25	14,0	5,9	
LIP (%)	Desnutrição energética	32	21,8	8,5	0,517
	Eutrofia	17	18,0	6,7	
	Sobrepeso/Obesidade	25	19,8	7,0	
Colesterol (mg)	Desnutrição energética	32	241,1	117,7	0,632
	Eutrofia	17	222,9	128,8	
	Sobrepeso/Obesidade	25	256,4	124,3	
Fibras (g)	Desnutrição energética	32	17,1	6,1	0,126
	Eutrofia	17	19,7	6,1	
	Sobrepeso/Obesidade	25	18,4	5,5	
Sódio (mg)	Desnutrição energética	32	1404,5	662,4	0,368
	Eutrofia	17	1096,8	444,3	
	Sobrepeso/Obesidade	25	1443,4	893,3	
Potássio (mg)	Desnutrição energética	32	1515,6	506,7	0,216
	Eutrofia	17	1283,1	376,3	
	Sobrepeso/Obesidade	25	1463,4	617,4	
Glicemia Jejum (mg/dL)	Desnutrição energética	32	146,1	71,5	0,716
	Eutrofia	17	133,4	38,1	
	Sobrepeso/Obesidade	25	150,9	65,4	
Hemoglobina Glicada (%)	Desnutrição energética	32	7,9	1,8	0,678
	Eutrofia	17	7,5	1,3	
	Sobrepeso/Obesidade	25	8,0	1,5	
Colesterol Total (mg/dL)	Desnutrição energética	32	190,5	33,4	0,452
	Eutrofia	17	180,9	42,0	
	Sobrepeso/Obesidade	25	178,4	42,2	
HDL (mg/dL)	Desnutrição energética	32	65,4	16,2	0,222
	Eutrofia	17	59,1	15,3	
	Sobrepeso/Obesidade	25	59,6	17,2	
LDL (mg/dL)	Desnutrição energética	32	99,5	35,3	0,749
	Eutrofia	17	97,3	36,5	
	Sobrepeso/Obesidade	25	91,8	36,5	
Triglicerídeos (mg/dL)	Desnutrição energética	32	117,3	56,5	0,028
	Eutrofia	17	144,5	38,1	
	Sobrepeso/Obesidade	25	143,1	56,8	

Teste de Associação Exato de Fisher
VET: Valor Energético Total
CH: Carboidrato
PTN: Proteína
LIP: Lipídeo
HDL: *High Density Lipoprotein*
LDL: *Low Density Liporotein*

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Na relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela PSC foi observado que os indivíduos em estado de desnutrição energética consumiam quantidades significativamente superiores de CH, com média de 33,1±12,7% (p=0,024). Indivíduos eutróficos pela PSC apresentaram valores de HG significativamente inferiores, com média de 7,0±1,2% (p=0,023) enquanto que a taxa de HDL, com média de 57,1±15,5 mg/dL, apresentou valores significativamente inferiores para sobrepeso/obesidade (p=0,030), apesar de valores significativamente superiores de TG, em um nível de 146,2±50,6 mg/dL, para sobrepeso/obesidade (p=0,021) (Tabela 3).

Tabela 3: Relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela prega cutânea subescapular

Variável	PSC	n	Média	Desvio Padrão	P
VET (kcal)	Desnutrição energética	20	1264,9	450,8	0,897
	Eutrofia	18	1316,7	545,5	
	Sobrepeso/Obesidade	36	1265,3	439,4	
CH (%)	Desnutrição energética	20	33,1	12,7	0,024
	Eutrofia	18	29,3	13,5	
	Sobrepeso/Obesidade	36	29,7	12,5	
PTN (%)	Desnutrição energética	20	14,6	5,2	0,597
	Eutrofia	18	13,9	5,8	
	Sobrepeso/Obesidade	36	13,3	6,0	
LIP (%)	Desnutrição energética	20	21,2	8,7	0,834
	Eutrofia	18	20,6	7,6	
	Sobrepeso/Obesidade	36	19,5	7,2	
Colesterol (mg)	Desnutrição energética	20	212,4	92,0	0,272
	Eutrofia	18	280,4	132,3	
	Sobrepeso/Obesidade	36	239,4	128,1	
Fibras (g)	Desnutrição energética	20	16,9	5,3	0,102
	Eutrofia	18	20,7	6,2	
	Sobrepeso/Obesidade	36	17,5	5,8	
Sódio (mg)	Desnutrição energética	20	1366,4	609,0	0,736
	Eutrofia	18	1261,7	713,1	
	Sobrepeso/Obesidade	36	1378,8	782,8	
Potássio (mg)	Desnutrição energética	20	1448,5	441,8	0,894
	Eutrofia	18	1468,0	471,7	
	Sobrepeso/Obesidade	36	1430,7	597,1	
Glicemia Jejum (mg/dL)	Desnutrição energética	20	153,5	85,9	0,182
	Eutrofia	18	121,8	20,0	
	Sobrepeso/Obesidade	36	151,5	60,4	
Hemoglobina Glicada (%)	Desnutrição energética	20	8,3	1,9	0,023
	Eutrofia	18	7,0	1,2	
	Sobrepeso/Obesidade	36	8,1	1,4	
Colesterol Total (mg/dL)	Desnutrição energética	20	185,2	31,8	0,969
	Eutrofia	18	184,6	40,8	
	Sobrepeso/Obesidade	36	183,5	41,5	
HDL (mg/dL)	Desnutrição energética	20	67,6	16,3	0,030
	Eutrofia	18	65,7	16,2	
	Sobrepeso/Obesidade	36	57,1	15,5	
LDL (mg/dL)	Desnutrição energética	20	93,4	27,2	0,889
	Eutrofia	18	98,4	37,0	
	Sobrepeso/Obesidade	36	97,1	39,7	
Triglicerídeos (mg/dL)	Desnutrição energética	20	121,3	70,3	0,021
	Eutrofia	18	116,7	29,6	
	Sobrepeso/Obesidade	36	146,2	50,6	

Teste não-paramétrico Kruskal-Wallis
VET: Valor Energético Total
CH: Carboidrato
PTN: Proteína
LIP: Lipídeo
HDL: *High Density Lipoprotein*
LDL: *Low Density Liporotein*

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O consumo alimentar e o perfil bioquímico sanguíneo relacionados ao RCV pela CP demonstraram que indivíduos com RCV consumiam uma quantidade significativamente maior de fibras em suas refeições, com média de 18,2±6,0g, (p=0,050), possuindo uma taxa sanguínea significativamente superior de HG, 7,9±1,6% (p=0,033) (Tabela 4).

Tabela 4: Relação do consumo alimentar e do perfil bioquímico sanguíneo com o risco cardiovascular pela circunferência do pescoço

Variável	CP	n	Média	Desvio Padrão	p
VET (kcal)	Baixo RCV	4	914,5	188,3	0,520
	Com RCV	70	1298,4	467,0	
CH (%)	Baixo RCV	4	22,0	5,1	0,146
	Com RCV	70	31,0	12,9	
PTN (%)	Baixo RCV	4	11,5	2,7	0,559
	Com RCV	70	13,9	5,8	
LIP (%)	Baixo RCV	4	16,6	3,5	0,838
	Com RCV	70	20,4	7,8	
Colesterol (mg)	Baixo RCV	4	216,4	142,5	0,108
	Com RCV	70	243,6	121,2	
Fibras (g)	Baixo RCV	4	16,1	4,3	0,050
	Com RCV	70	18,2	6,0	
Sódio (mg)	Baixo RCV	4	1121,0	181,3	0,501
	Com RCV	70	1359,8	732,3	
Potássio (mg)	Baixo RCV	4	1034,8	99,4	0,748
	Com RCV	70	1468,0	528,1	
Glicemia Jejum (mg/dL)	Baixo RCV	4	143,3	44,0	0,568
	Com RCV	70	144,9	63,9	
Hemoglobina Glicada (%)	Baixo RCV	4	7,1	1,2	0,033
	Com RCV	70	7,9	1,6	
Colesterol Total (mg/dL)	Baixo RCV	4	167,3	44,2	0,988
	Com RCV	70	185,2	38,2	
HDL (mg/dL)	Baixo RCV	4	74,8	11,2	0,640
	Com RCV	70	61,3	16,4	
LDL (mg/dL)	Baixo RCV	4	78,0	31,3	0,715
	Com RCV	70	97,5	35,8	
Triglicerídeos (mg/dL)	Baixo RCV	4	100,5	34,3	0,413
	Com RCV	70	134,1	54,4	

Teste não-paramétrico Mann-Whitney
VET: Valor Energético Total
CH: Carboidrato
PTN: Proteína
LIP: Lipídeo
HDL: *High Density Lipoprotein*
LDL: *Low Density Liporotein*
RCV: Risco Cardiovascular

A tabela 5 apresenta a relação entre o consumo alimentar e o perfil bioquímico sanguíneo com o RCV pela CC, na qual observou-se apenas que indivíduos com baixo RCV consumiam uma quantidade significativamente inferior de CH em suas refeições (p = 0,018).

Tabela 5: Relação do consumo alimentar e do perfil bioquímico sanguíneo com o risco cardiovascular pela circunferência da cintura

Variável	CC	n	Média	Desvio Padrão	p
VET (kcal)	Baixo RCV	7	933,3	161,2	0,099
	RCV elevado	8	1352,0	489,8	
	RCV muito elevado	59	1308,5	472,5	
CH (%)	Baixo RCV	7	20,7	3,3	0,018
	RCV elevado	8	35,4	14,0	
	RCV muito elevado	59	31,0	12,8	
PTN (%)	Baixo RCV	7	13,3	1,9	0,844
	RCV elevado	8	14,1	5,5	
	RCV muito elevado	59	13,8	6,0	

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LIP (%)	Baixo RCV	7	16,0	3,0	0,387
	RCV elevado	8	22,9	9,5	
	RCV muito elevado	59	20,4	7,7	
Colesterol (mg)	Baixo RCV	7	236,4	90,9	0,767
	RCV elevado	8	204,4	75,9	
	RCV muito elevado	59	247,9	129,6	
Fibras (g)	Baixo RCV	7	19,2	6,9	0,646
	RCV elevado	8	19,1	3,4	
	RCV muito elevado	59	17,8	6,1	
Sódio (mg)	Baixo RCV	7	1138,0	362,6	0,730
	RCV elevado	8	1334,2	816,7	
	RCV muito elevado	59	1373,5	737,1	
Potássio (mg)	Baixo RCV	7	1207,1	220,0	0,359
	RCV elevado	8	1542,8	425,2	
	RCV muito elevado	59	1459,4	556,2	
Glicemia Jejum (mg/dL)	Baixo RCV	7	184,0	92,4	0,087
	RCV elevado	8	143,4	105,4	
	RCV muito elevado	59	140,3	50,2	
Hemoglobina Glicada (%)	Baixo RCV	7	8,3	2,0	0,610
	RCV elevado	8	7,8	2,4	
	RCV muito elevado	59	7,8	1,4	
Colesterol Total (mg/dL)	Baixo RCV	7	170,0	36,6	0,522
	RCV elevado	8	180,3	35,8	
	RCV muito elevado	59	186,4	39,2	
HDL (mg/dL)	Baixo RCV	7	63,7	18,3	0,956
	RCV elevado	8	63,6	20,6	
	RCV muito elevado	59	61,6	15,9	
LDL (mg/dL)	Baixo RCV	7	87,0	21,2	0,643
	RCV elevado	8	90,1	34,1	
	RCV muito elevado	59	98,4	37,3	
Triglicerídeos (mg/dL)	Baixo RCV	7	157,4	102,1	0,903
	RCV elevado	8	120,5	44,1	
	RCV muito elevado	59	130,9	47,4	

Teste não-paramétrico Kruskal-Wallis
VET: Valor Energético Total
CH: Carboidrato
PTN: Proteína
LIP: Lipídeo
HDL: *High Density Lipoprotein*
LDL: *Low Density Liporotein*
RCV: Risco Cardiovascular

IV. Discussão

No presente estudo, houve maior predomínio do sexo feminino e grupo de idade idoso com mais de 70 anos, sendo que em relação ao estado nutricional a maioria da amostra encontrou-se em excesso de peso. De forma semelhante, um estudo realizado por Amorim *et al.*[27] sobre o perfil clínico e antropométrico de 244 pacientes com DM2 também apresentou maior predomínio do sexo feminino, faixa etária de 60 a 74 anos e estado nutricional de excesso de peso, corroborando ainda com estudos de Machado *et al.*[28], Pereira *et al.*[29], Natali *et al.*[30] e Pinheiro *et al.*.[31]

Vários são os estudos que demostraram o predomínio do sexo feminino, entre eles o estudo de Machado *et al.*[28] com 130 pacientes diabéticas e idade média de 60,8±10 anos, bem como os estudos de Pereira *et al.*[29], Natali *et al.*[30] e Pinheiro *et al.*[31]. Este alto índice no número de mulheres apresentado nesses estudos pode ser justificado, segundo Mohr *et al.*[32], pela maior preocupação das mesmas com sua saúde e a consequente procura por serviços de saúde, onde o sexo masculino é relapso na sua grande maioria quanto se refere ao assunto saúde.

Quanto ao estado nutricional, a maior parte da amostra do presente estudo apresentou excesso de peso, segundo a classificação do IMC. Em estudo realizado por Santos *et al.*[33], que objetivou conhecer o estado nutricional e hábitos alimentares de idosos com DM2 assistidos em uma UBS do município de Porteiras-CE, Brasil, a maioria, 60,0%, também apresentou excesso de peso pela mesma avaliação. Na DM2, o excesso de peso é um fator prevalente que está associado ao seu desenvolvimento e complicações em idosos, sendo resultante de alterações fisiológicas, de estilo de vida e dietéticas, onde a população idosa, por

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estas questões, apresenta uma redução na capacidade funcional e na força muscular que gera a dificuldade na prática de atividade física, a qual está relacionada com o controle de peso e estado nutricional.[34,35]

Em relação ao consumo alimentar, a maioria dos pesquisados do presente estudo apresentou uma baixa média para a ingestão de CH. Estes resultados diferem do encontrado por Vegnolli *et al.*,[36] que avaliou 27 indivíduos nos quais houve maior de consumo de CH, 60.53±14,55%, menor ingestão de PTN 13,1±0,53% e maior teor de LIP 27,13±8,23%, bem como dos achados de Baldoni *et al.*[37], que também avaliaram o consumo alimentar de 100 pacientes com DM2, cujo resultado também foi um maior consumo de CH, 56,2%, LIP, 24,5% e PTN, 19,4%, quando comparados ao atual estudo. Um estudo sobre o perfil nutricional de 73 idosos portadores de DM2, realizado por Fiore *et al.*[38] também apresentou uma baixa ingestão de CH entre a população pesquisada o que corrobora com o presente estudo. Segundo Santos *et al.*,[33] o baixo consumo de CH aponta para uma melhora nos marcadores da síndrome metabólica, mesmo na ausência da perda de peso, bem como, esse resultado também pode indicar um maior consumo de LIP e PTN.

Em uma pesquisa realizada por Miranda *et al.*[39] foi observado que a população caracterizou-se por apresentar predominância de sobrepeso, de acordo com o IMC, e desnutrição energética, segundo a PCT. Corroborando com os achados deste estudo. Além disso, o presente estudo, quando em comparação a Cortez *et al.*,[40] obteve resultados que podem ser considerados controversos, já que indivíduos em estado de desnutrição energética pelas medidas da PCT e PSC, consumiam quantidades significativamente superiores de CH. Tal fato pode ser explicado por fatores endógenos, como a constituição genotípica, metabolismo e outros fatores exógenos, como a independência para a execução das atividades da vida diária. Outro fator relacionado à redução da PCT e PSC é a tendência apresentada pela população idosa de regressão de sua massa muscular, chamada de sarcopenia.[41] Moreira *et al.*[42] explicam que a mensuração de medidas antropométricas em idosos, principalmente dobras cutâneas e perímetros, sofrem interferência do processo de perda de tecido muscular esquelético.

Em relação à CP, no presente estudo, verificou-se que o consumo de fibras foi maior entre os indivíduos com RCV. Esse resultado se encontra em dissonância com os obtidos por Frizon *et al.*[43] que realizou um estudo com 40 participantes e constataram que os indivíduos diabéticos com CP aumentada não apresentaram alterações significativas para RCV quanto ao consumo de fibras. Em comparação aos valores significativos para RCV entre hemoglobina glicosilada (HbA1c) e CP, Miralles *et al.*[44] em estudo com 24 diabéticos não observaram correlação significante para essa associação. Da mesma forma Silva *et al.*,[45] em uma pesquisa relacionando CP e resistência à insulina obtiveram uma correlação negativa entre CP e HbA1c, diferindo-se também deste estudo. Segundo Vinholes *et al.*,[46] uma grande parte da amostra estudada não apresentou HG dentro dos parâmetros desejáveis para DM2 implicando em aumento do risco de desenvolver doenças cardiovasculares no futuro. Tal fato se comprova por se tratar de um público sedentário, cuja alimentação não está de acordo com o preconizado para essa patologia.[47]

Entre as classificações de CC apenas a variável CH apresentou diferença significativamente inferior para os indivíduos com baixo RCV. Frizon *et al.*,[43] diferentemente do atual estudo, encontraram relação significativa entre RCV pela CC elevada e o alto consumo alimentar, sendo o grupo CH o de maior participação total. Outro estudo realizado por Silva *et al.*[45] foi verificado que apresentou risco muito elevado de complicações metabólicas pela aferição da CC, em portadores de diabetes, semelhante a pesquisa atual. Segundo Fiore *et al.*[38] em se tratando de idosos deve-se avaliar com cautela o acúmulo de gordura abdominal, visto que a redistribuição de gordura pode mascarar o diagnóstico de desnutrição.

Em um estudo sobre a prevalência de síndrome metabólica em 716 pessoas com DM2 realizado por Garcia *et al.*,[47] o sobrepeso e a obesidade foram caracterizados, em sua maioria 61,3%, pelo sexo feminino, e no que se refere a valores relacionados ao HDL, encontrou-se que a maior parte da amostra possuía baixos níveis desse tipo de colesterol. Já no presente estudo os níveis de HDL estavam compensados lembrando que houve HDL descompensado em indivíduos diabéticos, que se encontravam em excesso de peso pela PSC. Esta situação, segundo Sá, Alves e Navas,[48] pode estar relacionada ao consumo excessivo de ácidos graxos e ao sedentarismo, visto que esta população geralmente não tem o hábito de praticar atividade física.

Lima *et al.*,[49] analisaram parâmetros bioquímicos e antropométricos de 83 pacientes diabéticos cadastrados em uma Unidade de Estratégia de Saúde e Família, onde os resultados apontaram uma diminuição dos valores de HG em indivíduos diabéticos eutróficos, semelhantes aos achados do presente estudo, onde a HG atingiu valores inferiores para diabéticos eutróficos pela PSC. Isso se dá, devido ao baixo consumo de alimentos com alto índice glicêmico, conforme Sá, Alves e Navas.[48]

O presente estudo serve de alerta ao serviço público de saúde que precisa direcionar uma maior atenção à população adulta e idosa portadora de DM2 no sentido de realizar atividades preventivas relacionadas a esta patologia e oferecer uma maior assistência no que se refere à orientação deste público para hábitos de vida saudáveis.

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V. Conclusão

A amostra do presente estudo foi caracterizada em sua maioria por indivíduos de sexo feminino, com mais de 70 anos. O estado nutricional quanto ao IMC da maior parte dos avaliados foi representado pelo excesso de peso. Entretanto, a maioria apresentou eutrofia pela CB, enquanto que pela PCT a maioria apresentou algum grau de desnutrição em relação ao tecido adiposo, referindo baixa reserva de gordura corporal. Já, referente a PSC a maioria apresentou excesso de peso e, para a CP e CC, a maioria, evidenciou RCV e RCV muito elevado, respectivamente.

Constatou-se também que a metade dos indivíduos avaliados possuía GJ descompensada e que a maioria estava com HG também descompensada. Já, a maior parte da população estudada apresentou valores controlados para CT, bem como para níveis de HDL, LDL, TC e PA.

Quanto a relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela com PCT foi observado que os indivíduos em estado de desnutrição energética consumiam quantidades significativamente superiores de CH e possuíam taxa de TG significativamente inferior.

Na relação do consumo alimentar e do perfil bioquímico sanguíneo com o estado nutricional pela PSC foi observado que os indivíduos em desnutrição energética consumiam quantidades significativamente superiores de CH, enquanto que indivíduos eutróficos apresentaram valores de HG significativamente inferiores, sendo a taxa de HDL, com valores significativamente inferiores para indivíduos em sobrepeso/obesidade, apesar de valores significativamente superiores de TG para estes mesmos indivíduos.

O consumo alimentar e o perfil bioquímico sanguíneo relacionados ao RCV pela CP demonstraram que indivíduos com RCV consumiam uma quantidade significativamente maior de fibras, possuindo uma taxa sanguínea significativamente superior de HG. Já a relação entre o consumo alimentar e o perfil bioquímico sanguíneo com o RCV pela CC revelou que indivíduos com baixo RCV consumiam uma quantidade significativamente inferior de CH em suas refeições.

Diante dos achados do presente estudo conclui-se que existe relação entre o estado nutricional, o consumo alimentar e níveis bioquímicos de sangue. Em vista disso, expõe-se a necessidade constante de programas voltados ao acompanhamento nutricional dos pacientes diabéticos a fim de lhes auxiliar no controle do estado nutricional, da bioquímica do sangue e do risco para o desenvolvimento de doenças cardiovasculares garantindo-lhes melhor qualidade de vida.

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Prebiotic Beverage from *Smallanthus Sonchifolius* Sweetened with Stevia

By Elizabét Contreras Prado, Paola Purisaca-Salinas, Cesar Moreno-Rojo & Jhoseline Guillén-Sánchez

Abstract- The objective of this study was to develop a prebiotic beverage from yacon and pineapple sweetened with stevia. Nine functional beverage formulations were prepared. The yacon and the pineapple were incorporated in three proportions, P1: 30-70, P2: 50-50 and P3: 70-30, respectively. The selection of the optimal treatment was made by sensory analysis. The physicochemical analyzes of the optimal formulation evaluated were pH, acidity, total soluble solids, instrumental color and % Fructo oligosaccharides (FOS) (1-Kestose and Nystose). For the interpretation of results, a randomized design with a 3 x 3 factorial arrangement was used. Beverages P1 and P2, obtained the highest score on a scale of 9 points ($p > 0,05$); however, the latter had a higher percentage of FOS (0,19%). The beverage presented the following physicochemical characteristics, pH: 3,58 ± 0,03, Total soluble solids: 5 ± 0,01 ° Brix, Acidity: 0,36 ± 0,01%, Density: 1,02 ± 0,01g / ml, Viscosity: 13,55 ± 0,15 cP, Color Index: -14,03 ± 1,65 and FOS (1-Kestose: 0,06% and Nystose: 0,13%).

Keywords: prebiotic beverage; yacon; stevia; fructo-oligosaccharides; sensory analyses.

GJMR-L Classification: NLMC Code: QU 145



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Prebiotic Beverage from *Smallanthus Sonchifolius* Sweetened with Stevia

Bebida Prebiótica de *Smallanthus Sonchifolius* Edulcorado Con Stevia

Elizabét Contreras Prado [α], Paola Purisaca-Salinas [σ], Cesar Moreno-Rojo [ρ] & Jhoseline Guillén-Sánchez [ω]

Resumen- El objetivo de este estudio fue desarrollar una bebida prebiótica de yacon y piña edulcorada con estevia. Se elaboraron nueve formulaciones de bebidas funcionales. El yacon y la piña fueron incorporadas en tres proporciones, P1:30-70, P2:50-50 y P3:70-30, respectivamente. La selección del tratamiento óptimo, se realizó mediante análisis sensorial. Los análisis fisicoquímicos de la formulación óptima evaluada fueron pH, acidez, sólidos solubles totales, color instrumental y % Fructo oligosacáridos (FOS) (1-Kestose y Nystose). Para la interpretación de resultados se utilizó un diseño aleatorio con arreglo factorial 3 x 3. Las bebidas P1 y P2, obtuvieron la mayor puntuación en una escala de 9 puntos (p>0,05); sin embargo, esta última presentó mayor porcentaje de FOS (0,19%). La bebida presentó las siguientes características fisicoquímicas, pH: 3,58±0,03, sólidos solubles totales: 5±0,01°Brix, Acidez: 0,36±0,01%, Densidad: 1,02±0,01g/ml, Viscosidad: 13,55±0,15 cP, Índice de color:-14,03±1,65 y FOS (1-Kestose: 0,06% y Nystose: 0,13%).

Palabras claves: bebida prebiótica; yacon; estevia; fructo-oligosacáridos; análisis sensorial.

Abstract- The objective of this study was to develop a prebiotic beverage from yacon and pineapple sweetened with stevia. Nine functional beverage formulations were prepared. The yacon and the pineapple were incorporated in three proportions, P1: 30-70, P2: 50-50 and P3: 70-30, respectively. The selection of the optimal treatment was made by sensory analysis. The physicochemical analyzes of the optimal formulation evaluated were pH, acidity, total soluble solids, instrumental color and % Fructo oligosaccharides (FOS) (1-Kestose and Nystose). For the interpretation of results, a randomized design with a 3 x 3 factorial arrangement was used. Beverages P1 and P2, obtained the highest score on a scale of 9 points (p> 0,05); however, the latter had a higher percentage of FOS (0,19%). The beverage presented the following physicochemical characteristics, pH: 3,58 ± 0,03, Total soluble solids: 5 ± 0,01 ° Brix, Acidity: 0,36 ± 0,01%, Density: 1,02 ± 0,01g / ml, Viscosity: 13,55 ± 0,15 cP, Color Index: -14,03 ± 1,65 and FOS (1-Kestose: 0,06% and Nystose: 0,13%).

Keywords: prebiotic beverage; yacon; stevia; fructo-oligosaccharides; sensory analyses.

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I. Introducción

La tendencia mundial en la ciencia de la nutrición humana, indica el interés de los consumidores de prevenir enfermedades mediante el consumo de alimentos naturales que van más allá del olor, sabor, textura y/o valor nutricional. Por esta razón, a finales del siglo XX, la industria de alimentos se encargó de innovar y lanzar al mercado, alimentos que cumplan estas características exigidas por el consumidor (Trescastro & Bernabeu, 2015). Hoy en día, estos alimentos se conocen como "Alimentos Funcionales", dentro de los cuales se encuentran las bebidas funcionales (Díaz, 2014). Estas bebidas no presentan alcohol en su composicion pero sí, ingredientes nutraceuticos como vitaminas, minerales, aminoácidos, prebióticos y demás compuestos bioactivos que brindan beneficios específicos para la salud humana (Chandra et al., 2014).

Según Fuentes et al. (2015), la producción de alimentos funcionales va cada día en aumento a tasas del 48 % anual y con valores para el mercado mundial de $167 mil millones (Eggersdorfer & Wiss, 2018).Los alimentos como el yacon y la piña son considerados alimentos funcionales debido al contenido de prebióticos y fitonutrientes, que presentan en su composición. El yacon, contiene fructo oligosacáridos (6-12%), prebióticos que se metabolizan en el organismo como fibra soluble aportando menos cantidad de carbohidratos y evitando la elevación de glucosa en sangre (Lebeer et al., 2010). Por otra parte, la piña contiene bromelina (13%-18%), una enzima digestora de proteína que ayuda a descomponerla en aminoácidos simples para su mejor aprovechamiento en el organismo, además aportan un efecto analgésico, antitrombótico, antifibrinolítico y antiinflamatorio (Caballero-Gutiérrez & Gonzales, 2016; López et al., 1996; Nkudo et al., 2018.). Complementando dicha funcionalidad, el uso de stevia en alimentos adiciona propiedades hipoglucemiantes, vasodilatadoras y antibacterianas (Ghosh et al., 2008; Lemuset al., 2012).

El siguiente trabajo tiene por objetivo elaborar una bebida funcional a base de yacon y piña, endulzado con stevia, evaluando sus características fisicoquímicas y sensoriales y asi contribuir a la innovacion de alimentos funcionales.

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II. Materiales y Métodos

LaInvestigación fue realizada en los laboratorios de la Escuela de Ingeniería Agroindustrial y en el Instituto de Investigación Tecnológica Agroindustrial de la Universidad Nacional Del Santa.

a) Materia prima e insumos

i. *Obtención del extracto de yacon y de piña*

El yacon variedad blanco y la piña variedad española roja, fueron lavadas y desinfectadas con hipoclorito de sodio a 50 ppm (yacon) y 150 ppm (piña). El pelado y cortado fue realizado manualmente y se utilizó un extractor doméstico marca Nationalstar.

ii. *Bebida prebiótica*

Los extractos fueron diluidos en agua de acuerdo a la tabla 1. Se prepararon 9 formulaciones, y cada formulación contenia 0,14% de CMC y 0,08% de stevia.

Tabla 1: Bebidas funcionales con diferentes proporciones y diluciones de extractos de yacon y piña.

Formulación	Proporción (P)	Dilución (D)
F_1	30%Y-70%P	1:1
F_2	50%Y-50%P	1:1
F_3	70%Y-30%P	1:1
F_4	30%Y-70%P	1:1.5
F_5	50%Y-50%P	1:1.5
F_6	70%Y-30%P	1:1.5
F_7	30%Y-70%P	1:2
F_8	50%Y-50%P	1:2
F_9	70%Y-30%P	1:2

La pasteurización se realizó en una cocina eléctrica, a 90°C por 2 minutos. Los envases de vidrio y las tapas de metal tipo "twist off 38 mm" fueron esterilizados a 121°C por 15 minutos. Las bebidas fueron envasadas a 85°C y selladas herméticamente. El producto fue enfriado con agua a temperatura ambiente para conservar su calidad y asegurar la formación del vacío, y se almacenaron a 4°C hasta análisis.

b) Análisis fisicoquímicos

Se determino color mediante el Método CIELAB (1986), según CIE L* a* b* (1986), pH mediante Método potenciometrico AOAC 981.12 (2005), indice de Acidez (AI) por el método de AOAC 942.15 (2005) y el contenido de Solidos solubles (°Brix) fue determinado por el método AOAC 931.12 (2005). La viscosidad fue determinada siguiendo la metodologia de Jansen et al. (1981) y Marquis et al. (1993), la densidad relativa (RD) por método del picnómetro según la NTE INEN 2 150:99. La determinación de Azúcares reductores y vitamina C fueron medidos por el método acido 3,5 dinitro salicico, según Miller (1959), y el Método 2,6 diclorofenol indofenol, según Ciancaglini (2001), respectivamente. La determinación de Fructo-oligosacáridos (FOS) se realizó el procedimiento señalado por Jaime et al. (2001) con algunas modificaciones.

c) Análisis Sensorial

Se llevó a cabo con 50 panelistas semi-entrenados, bajo condiciones apropiadas. Se evaluaron tres características sensoriales (sabor, color y olor) y la aceptabilidad general utilizando una escala hedónica de 9 puntos (Tabla 2) (Ramírez-Navas, 2012).

Tabla 2: Escala hedónica de 9 puntos utilizada para la evaluación sensorial de color, olor, sabor y aceptabilidad general

Puntaje	Calificación
1	Me disgusta extremadamente
2	Me disgusta mucho
3	Me disgusta moderadamente
4	Me disgusta levemente
5	No me gusta ni me disgusta
6	Me gusta levemente
7	Me gusta moderadamente
8	Me gusta mucho
9	Me gusta extremadamente

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d) Analisis estadistico

Los resultados fueron tratados estadísticamente mediante el programa STATGRAPHICS Centurión (versión 2014, USA). El diseño empleado fue aleatorio con arreglo Factorial 3x3, Para determinar las diferencias significativas entre las formulaciones se utilizó el test de Duncan, $p<0,05$.

III. Resultados y Discusión

a) Caracterización fisicoquímica de los extractos

Tabla 3: Características fisicoquímica del extracto de yacon y el extracto de piña

Características	Yacon	Piña
Humedad (%)	89,33± 0,27	92,52± 0,02
Cenizas (%)	0,67 ± 0,04	0,47 ± 0,03
Proteínas (%)	0,34 ± 0,08	0,69± 0,09
pH	6,28± 0,01	3,68 ± 0,01
Acidez (%)	0,31 ± 0,02	0,77± 0,02
Solidos Solubles (°Brix)	6,97 ± 0,21	10,07 ± 0,06
Color		
L*	38,30± 1,39	39,50 ± 2,48
C*	8,52 ± 1,17	9,68 ± 1,73
IC	-1,90 ± 1,22	-4,62 ± 1,59
Azucares Reductores (%)	0,41 ± 0,21	0,07± 0,01
Vitamina C (mg/100ml)	9,00± 0,01	7,23 ± 0,04
Fructo-oligosacáridos		
Nystose (%)	0,20	n.d.
1-Kestose (%)	0,39	n.d.

*Resultados expresados en base húmeda y presentados en medias ± desviación estándar (n = 3).
n.d. (no determinado)

De acuerdo con la tabla 2, el contenido de humedad, cenizas, acidez y solidos solubles fueron similares a los obtenidos por Ynouye (2005) y Mejía (2016). El pH del yacon fue de 6,28 ± 0,01, econtrandose dentro del rango obtenido por Roberfroid (1993)y por Vilhenaet al. (2000). Según Palomino & Ríos (2004), el pH y los sólidos solubles tienen una relación inversamente proporcional con la acidez, durante el proceso de maduración del yacon.

Según Fukay et al. (1995), el contenido de solidos solubles depende de la actividad de las enzimas de polimerización y despolimerización de las cadenas de fructanos, como las hidrolasas e invertasas presentes en el yacon. El contenido de vitamina C y proteínas fue inferior a lo reportado por Jiménez & Sammán (2014) y Carvalho-Salvador et al. (2012), pudiendo ser debido a las diferencias en las operaciones de cortado, pelado o desestructuración de la materia prima y las condiciones de cultivo.

El parámetro L* de los extractos indican un color opaco, encontrándose en el rango de -2 a +2, indicando un color amarillento.Para el análisis FOS, se determinó la cantidad de Nystose y 1-Kestose, debido a que el FOS es una combinación de tres moléculas de azúcar: 1-kestose, nystose y nystose frutofuranosyl, siendo las 2 primeras el componente mayoritario cuando la fructosiltransferasa se combina con sacarosa a la posición β (2 → 1) (Lewis, 1993). Los valores obtenidos fueron 0,20% de nystose y 0,39% de 1-kestose; valores inferiores a lo reportado por Seminario et al.(2003). Esta diferencia puede ser debido a que nuestros análisis se hicieron en el extracto de yacon y no en el alimento en fresco.

En el extracto de piña, el contenido de cenizas, proteinas y acidez fueron similares a los reportados por Macias-Ganchozo et al. (2017) y Morais et al. (2017). El valor de pH obtenido fue cercano al obtenido por Siriano-Borges et al. (2011), pH 3, 74.

El CODEX STAN 182-1993, menciona que el contenido mínimo de sólidos solubles totales en la pulpa de piña debe ser 12° Brix; sin embargo, dicho valor fue superior al encontrado en esta investigación, infiriendose que las frutas fueron cosechadas fuera de temporada (en el invierno) (Macrae et al., 1993).

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b) Analisis sensorial de las bebidas funcionales

La tabla 4 muestra el analisis sensorial de las formulaciones realizado a 50 panelistas semi-entrenados. Las formulaciones F1 y F2 ($p>0,05$) obtuvieron mayor puntaje en el analisis sensorial. La elección de la formulación óptima entre F1 y F2, se definió según la cantidad de FOS presentes en cada una de ellas, con la finalidad de lograr un mayor efecto positivo en la salud del consumidor. La tabla 5 detalla el contenido de FOS de F1 y F2.

Tabla 4: Puntuaciones medias obtenidas por formulación de bebida.

Formulación	Proporción (P)	Dilución (D)	Puntaje
F1	30%Y-70%P	1:1	6,63±0,25[a]
F2	50%Y-50%P	1:1	6,70±0,55[a]
F3	70%Y-30%P	1:1	6,38±0,55[b]
F4	30%Y-70%P	1:1.5	6,01±0,32[b]
F5	50%Y-50%P	1:1.5	6,33±0,41[b]
F6	70%Y-30%P	1:1.5	6,16±0,42[b]
F7	30%Y-70%P	1:2	6,17±0,18[b]
F8	50%Y-50%P	1:2	6,25±0,23[b]
F9	70%Y-30%P	1:2	5,90±0,20[b]

*Resultados en medias ± desviación estándar (n = 3).

Tabla 5: Contenido de FOS de las fomulaciones F1 y F2

Formulación	1-Kestose (%)	Nystose (%)	Total FOS (%)
F1	0,05± 0,01[a]	0,10± 0,01[a]	0,15± 0,01 [a]
F2	0,06± 0,01[a]	0,13± 0,0[a]	0,19± 0,01[a]

*Letras iguales significan que no hay diferencia significativa ($p> 0,05$) entre las formulaciones para el cotenido de FOS. Contenido de FOS de las bebidas funcionales con formulación F1 y F2.

c) Caracterización fisicoquímica y composición nutricional de F2

Tabla 6: Características fisicoquímicas de la formulación óptima F2

Composición	Valores
pH	3,58 ± 0,03
Acidez (%)	0,36 ± 0,01
Densidad (g/ml)	1,02 ± 0,01
Solidos Solubles (°Brix)	5,00 ± 0,01
Viscosidad (cP)	13,55 ± 0,15
Color	
L*	31,83 ± 0,25
C*	2,56 ± 0,56
IC	-14,03 ± 1,65

*Resultados expresados en base húmeda y presentada en medias ± desviación estándar (n = 3).

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Según la Norma Técnica Peruana NTP 203.110:2009, establece que las bebidas de frutas deben estar dentro de un rango de pH de 3,3 – 4,2, por lo que el pH de la bebida funcional se encuentra dentro de lo especificado. Asimismo, según AAPPA (2004) la bebida funcional obtenida estaría categorizada dentro de los alimentos con alta acidez (pH < 4,5), encontrandose dentro del rango especificado por el CODEX STAN 192-1995.Los valores de densidad fueron similares a los reportados por Guzmán (2015) y Santander et al. (2017), en bebidas mixtas.

La cantidad de solidos solubles obtenidos fue inferior a lo establecido por la norma NTP 203.110:2009, la cual estable valores entre 12-18°Brix. Esto puede ser debido al uso de stevia como endulzante, el cual es considerado como "light" por su bajo aporte de sólidos y calorías, adquiriendo un poder edulcorante mucho mayor que los azúcares comunes, sacarosa y glucosa. Es por ello que Guzmán (2015) reportó también valores bajos de solidos solubles (3°Brix), en una bebida de mango endulzada con stevia.

La viscosidad fue de 13,55 ± 0,15 cP, encontrandose dentro del rango de alimentos de viscosidad fina tales como agua y bebidas en general 1-50 Cp (Garcíaet al., 2016). Estos valores de viscosidad permiten que las bebidas sean ingeridas con facilidad, a diferencia de los néctares que presentan alta concentración de solidos solubles y viscosidad (Chinet al., 2009). El IC indica que los colores van del verde profundo al verde amarillento. La Tabla 7, muestra la composición nutricional de F2.

Tabla 7: Composición nutricional la formulación óptima en 100 ml de bebida

Composición	Valores
Humedad (%)	91,33 ± 0,01
Cenizas (%)	0,67 ± 0,04
Proteínas (%)	0,31 ± 0,07
Vitamina C (mg/100ml)	2,97 ± 0,01
Fructooligosacáridos	
Nystose (%)	0,06
1-Kestose (%)	0,13

*Resultados expresados en base húmeda y presentada en medias ± desviación estándar (n = 3).

El contenido de vitamina C fue inferior a lo reportado por Valencia & Guevara(2013) en néctar de zarzamora (3,87 mg/100g). Según Rossi & Pighín (2010), el contenido de vitamina C puede ser muy variable debido a causas genotípicas como el manejo pre y pos cosecha. Además, la vitamina C puede degradarse fácilmente por exposición al calor y por oxidación (Ravani & Joshi, 2011). El contenido de fructooligosacáridos fue de 0,19 % (0,06% de Nystose, 0,13% de 1-Kestose), valor inferior a lo reportado en la investigacion de Chimbor & Espinoza (2010) para un néctar de melocotón-yacon, el cual obtuvo 1,30% de FOS.

De acuerdo con Seminario et al.(2003), el consumo diario de FOS no debe exceder de 0,3 y 0,4 g/Kg peso corporal en hombres y mujeres, respectivamente. Dosis superiores a 20 g de FOS al día pueden producir flatulencia y presión abdominal, y dosis por encima de 50 g frecuentemente ocasionan diarrea.

IV. Conclusiones

La formulación óptima fue la conformada por 50% extracto de yacon y 50% extracto de piña, ya que obtuvo buena aceptación por el consumidor.

Los parámetros fisicoquímicos tales como acidez y pH de la formulación óptima se encuentran dentro del rango establecido por la Norma Técnica Peruana para Jugos, Néctares y Bebidas de frutas.

La cantidad de fructo oligosacáridos presentes en la bebida fue 0,19%, de los cuales 0,06 % fue 1-Kestose y 0,13% fue Nystose. Asimismo, el aporte de stevia otorgó un producto con bajo valor calórico y fibra dietética, lo que constituye la funcionalidad de la bebida.

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Assessment of the Sensory Acceptability of Soy Milk based Sandesh (Traditional Indian Sweet Dairy Dessert) for Elderly People (Aged>60 Years) Living in Kolkata and its Efficacy on the Health Status of Geriatric Population

By Sweata Rani Rai & Sabia Nazmin

Abstract- *Background:* Aging is often associated with the incidence of degenerative diseases such as cardiovascular, cerebrovascular diseases, diabetes, osteoporosis, and cancer, which affects dietary eating patterns in older adults. With advancing age, there is a decline in appetite and a reduced affinity to food. However, the eighty million citizens of West Bengal including the older adults have a craving for sweets. Therefore, the present study aims to evaluate the sensory and chemical evaluation of Sandesh prepared from soymilk and dates adhering to nutritional needs and dietary preference towards sweets for older adults.

Method: Sandesh is prepared with the substitution of traditional milk chenna (fresh, unripened curd cheese made from cow milk/ buffalo milk) with soy milk and dates syrup.

Keywords: *non-dairy sandesh, geriatrics, degenerative diseases, functional food.*

GJMR-L Classification: *NLMC Code: QU 145*



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Assessment of the Sensory Acceptability of Soy Milk based Sandesh (Traditional Indian Sweet Dairy Dessert) for Elderly People (Aged>60 Years) Living in Kolkata and its Efficacy on the Health Status of Geriatric Population

Sweata Rani Rai [α] & Sabia Nazmin [σ]

Abstract- ***Background:*** Aging is often associated with the incidence of degenerative diseases such as cardiovascular, cerebrovascular diseases, diabetes, osteoporosis, and cancer, which affects dietary eating patterns in older adults. With advancing age, there is a decline in appetite and a reduced affinity to food. However, the eighty million citizens of West Bengal including the older adults have a craving for sweets. Therefore, the present study aims to evaluate the sensory and chemical evaluation of Sandesh prepared from soymilk and dates adhering to nutritional needs and dietary preference towards sweets for older adults.

Method: Sandesh is prepared with the substitution of traditional milk chenna (fresh, unripened curd cheese made from cow milk/ buffalo milk) with soy milk and dates syrup. Sensory evaluation of these two ingredients with graded variations (5gm, 10gm, 15gm, 20gm& 25 gm) of pumpkin seeds and watermelon seeds was carried out by 25 males and 25 females older adults (aged >60 years) at St Joseph's Old Age Home, Kolkata. The standard and the most approved product is further analyzed for physical and chemical parameters.

Result & Discussion: As per the product acceptability, the variation with 20g Soymilk chenna+1.25g cardamom powder+1.25ml rose water+10ml dates syrup+5g watermelon seeds+5g pumpkin seeds was the best sample. One serving (50g) of the product provided 5.1g of protein, 12.5g of carbohydrate, 7.3g of fat, 2.6mg of iron, 93.1mg of calcium, 13mg of phosphorus, and the total antioxidant activity (%) was 30 %. These nutrients are of more significance in terms of prevention and retardation of degenerative diseases associated with aging in the elderly.

Conclusion: Sandesh fortified with soya milk chenna, dates, pumpkin seeds, and watermelon seeds can prove beneficial for the overall health of the elderly population and also reduce the risk of morbidity.

Keywords: non-dairy sandesh, geriatrics, degenerative diseases, functional food.

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I. Introduction

Nutrition acts as an important modifiable determining factor of age-related decline and associated degenerative diseases like obesity, hypertension, and diabetes.[16] Most importantly, dietary adjustments and alterations not only influence present health but can also determine the quality of life in old age.[8]People of West Bengal are traditionally sweet lovers and have always been known for their particular weakness for sweets. Even the older adults are no exception to these sweet cravings. [4]

Sandesh represents the traditional Indian dairy product, which is very common in every household of Eastern India.[17]The traditional method of Sandesh making involves the preparation of chhana (fresh, unripened curd cheese made from cow/ buffalo milk), mixed with sugar (30-35% of chhana), kneaded and cooked at 70-75°C for 10-15 minutes (Fig. 1).The cooked mass was transferred to moulds for desirable shape. The traditional Sandesh, which is prepared by the addition of cow milk chhana and sugar, was replaced by soymilk chhana and dates, respectively, and for further, enrichment pumpkin seed and watermelon seed were added to enhance the nutritional property of the Sandesh.

II. Materials & Methodology

a) Study Design

The sensory evaluation of the product with variations is done by 50- panel members comprising of 25 males and 25 females older adults (aged>60 years) residing at St Joseph's Old Age Home, Kolkata. Prior permission is taken from the authorities of the nursing home. The nature, purpose, and objectives of the study is also explained to the inmates and confidentiality was assured. Written informed consent is also taken.

The preparation of the product is carried out in the food and chemistry laboratories of J. D. Birla Institute, Kolkata. All the ingredients are collected from departmental stores in Central Avenue, Kolkata.

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b) Product Development

The Sandesh is made with substitution of traditional chenna and sugar with soymilk chenna and dates syrup with varying proportions of graded variations (5gm, 10gm, 15gm, 20gm& 25 gm) of pumpkin seeds and watermelon seeds. The variations are given in (Table 1).The products are then evaluated for sensory and nutritional parameters for production of Sandesh[3]

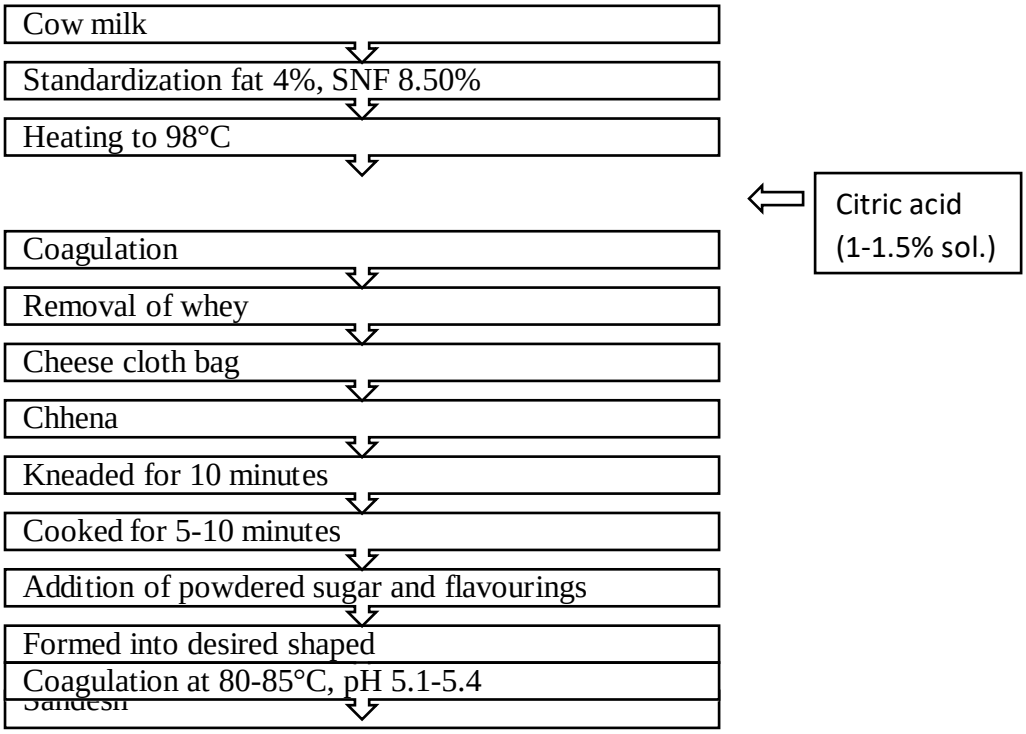


Fig. 1: Flow diagram for production of Sandesh[3]

Table 1: Variations of Sandesh

Product Code	Additional Ingredients
Product B	20g cow milk chhena+5g powdered sugar+1.25g cardamom powder+5ml rose water
Product S	20g soymilk chhena+5g powdered sugar+ 1.25g cardamom powder+5ml rose water
Product A1	20g soy milk chhena+ 5ml dates syrup+ 1.25g cardamom powder+1.25ml rose water
Product A2	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water
Product A3	20g soy milk chhena+15ml dates syrup+1.25g cardamom powder+1.25ml rose water
Product B1	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+5g watermelon seeds
Product B2	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds
Product B3	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+15g watermelon seeds
Product B4	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+20g watermelon seeds
Product B5	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+25g watermelon seeds
Product C1	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+5g pumpkin seeds
Product C2	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+10g pumpkin seeds

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Product C3	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+15g pumpkin seeds
Product C4	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+20g pumpkin seeds
Product C5	20g soy milk chhena+10ml dates syrup+1.25g cardamom powder+1.25ml rose water+10g watermelon seeds+25g pumpkin seeds

c) Sensory analysis

Attributes to be scored were appearance, color, flavor, texture, taste, and overall rating. Each variation of the Sandesh is placed with corresponding codes. A sensory evaluation sheet comprising of a 9-point hedonic scale is also given. The panel members are briefed with the process of evaluation.

Chemical analysis of the standard (S) and most approved variation (C2) chosen by the panel members are performed.

d) Estimation of Proteins

The protein content of the samples was measured using the Biuret method. Bovine serum albumin (BSA) at a concentration of 1mg/dl is used as the standard protein solution. The standard protein solutions of 0.2ml, 0.4 ml, 0.6 ml, 0.8 ml were taken in test tubes, and the volume was made up 1ml by addition of distilled water. For the test samples, 1ml of the test sample is taken in separate test tubes, and 4ml of the Biuret reagent was added and incubated at room temperatures for 30 minutes. The optical density is then measured at 550 nm. The concentration of the protein sample was determined using a standard curve. [9]

e) Estimation of Fat

The determination of fat is done by Rose Gottlieb method. 10gm of the sample was weighed and transferred to the extraction tube and 1.25ml of ammonia was added and mixed. Further, 25ml of diethyl ether (peroxide free) is added, stoppered and shaked vigorously for a minute. 25 ml of petroleum ether was also added and shaken for about half a minute and was allowed to stand still followed by decantation. The extraction process is repeated twice, and drying was carried out in hot air oven at 102 ℃ for two hours, cooled in a desiccator, and weighed. Fat calculation:

$$\text{Fat (gms)} = \text{Weight of extracted fat/ weight of the sample}$$ [10]

f) Estimation of Total carbohydrates

The determination of the total carbohydrate is done by the Anthrone method. 1gm of the sample was taken in a boiling tube and hydrolyzed by keeping it in a boiling water bath for three hours with 10 ml of 2.5 N HCL. Afterward, the sample was cooled to room temperature and neutralized with sodium carbonate until the effervescence ceases. The volume of the test sample was made up to 100 ml and centrifuged at 3000-4000g. The supernatant was collected, and 1 ml of the aliquot is used for analysis. 4ml of anthrone reagent was added to it and is heated for 10 minutes in a boiling water bath. The absorbance was measured at 630nm using a spectrophotometer. D-glucose at a concentration of 1mg/dl is used as the standard for the estimation. The amount of total carbohydrate present in the sample is calculated using the standard curve. [26]

g) Estimation of Calcium

The estimation of calcium was carried out by O-Cresolpthalein Complexone (OCPC) method. OCPC combined with calcium at alkaline pH to form a purple colored complex, the absorbance which was measured at 578nm. The recommended volumes of kit agents (Coral Clinical System, India) are added to the test tubes labeled as blank, standard, and test samples. The reaction mixtures are incubated at room temperatures for 5 minutes, followed by measurement of absorbance of the samples at 578 nm.

Calcium concentration calculation:

$$\text{Calcium (mg/dl)} = [\text{Absorbance of test/ Absorbance of standard}] \times 10$$ [23]

h) Estimation of Iron

The estimation of iron is done by the Ferrozine method, where Fe II ions reacted with Ferrozine to form a violet colored complex. The recommended values of kit reagents (Coral Clinical Systems, India), buffer solution, color reagent, and standard solutions are added to the test tubes labeled as blank, standard, and test. The mixtures are then incubated at room temperature for 5 minutes, and the absorbance is measured at 578nm. The concentration of iron is determined by the following formula:

$$\text{Iron } (\mu\text{M}) = [\text{Absorbance of test/ Absorbance of standard}] \times 35.8$$ [6]

i) Estimation of Phosphorus

Estimation of phosphorus is done by the Molybdate UV method, where the phosphate ions in an acidic medium react with ammonium molybdate to form a phosphomolybdate complex. The absorbance was then measured at 340 nm. The intensity of the complex formed is directly proportional to the amount of inorganic phosphorus present in the sample. The ash solution is dissolved in 10ml of 6N HCL, warmed over a water bath, and filtered through Whatman filter paper. 1ml of the working reagent is added to the blank, standard and test. The concentration of phosphorus is determined by the following formula:

$$\text{Phosphorus (mg/dl)} = [\text{Absorbance of test/ Absorbance of standard}] \times 5$$ [15]

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j) Estimation of total antioxidant capacity

The free radical scavenging activity of the samples was determined using a 2, 2-diphenyl-1-2-picrylhydrazyl (DPPH) method. An aliquot of 2ml of 0.15mM DPPHin ethanol is added to the test tube with 1ml of the sample extract. The reaction mixture was vortex mixed and left to stand at room temperature in the dark for 20 minutes. The absorbance is then measured at 517nm with the help of a spectrophotometer. The control sample is prepared without adding extract.

%TAA= [1-(Absorbance of the sample/Absorbance of control)]X 100 [12]

k) Statistical Analysis

The standard deviation and student t- test are done of all the sensory attributes of the standard variation and most approved variation. The mean score is also estimated for the most approved variation with the standard recipe.

Calculation: $t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{(s_1)^2/n_1 + (s_2)^2/n_2}}$

Where,

$\bar{x}_1$ = is the mean of the standard
s_1 = is the standard deviation of the standard
n_1 = is the no. of individuals in standard
$\bar{x}_2$ = is the mean of the most approved
s_2 = is the standard deviation of the most approved
n_2 = is the no. of individuals in most approved

III. Results and Discussion

a) Sensory evaluation of basic and standard

Acceptability of products is evaluated from the ratings obtained through the scorecard using 9 points hedonic scale during the sensory evaluation. When the mean score of the sensory attributes of the standard (S) is compared with the most approved variation (C2), there was no significant difference observed which can lead to higher acceptability of the product.

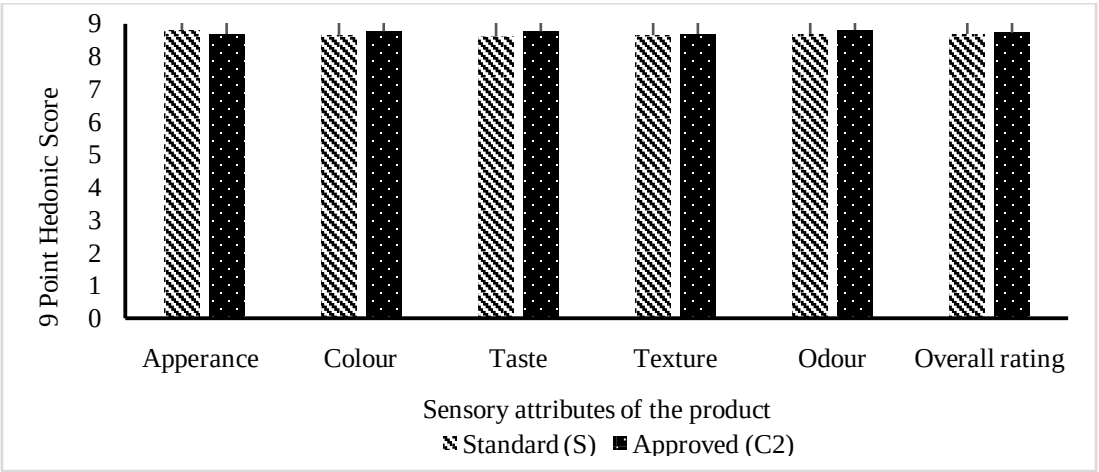


Figure 2: Comparison of student t-test of sensory attributes of standard(S) and most approved variation (C2)

Product code

S	20g Soymilk chenna+1.25g cardamom powder+1.25ml rose water+10ml dates syrup
C2	20g Soymilk chenna+1.25g cardamom powder+1.25ml rose water+10ml dates syrup+5g watermelon seeds+5g pumpkin seed

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b) Macronutrient analysis of standard (S) and most approved product (C2)

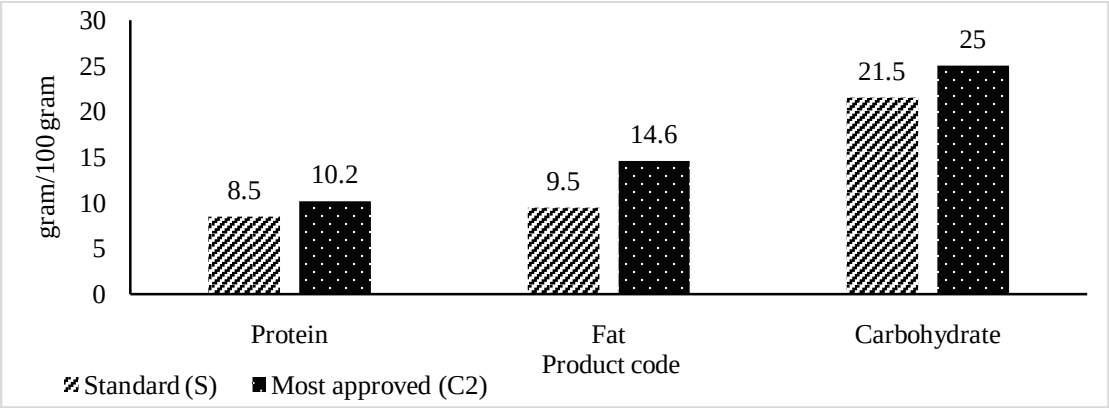


Figure 3: Comparison of protein, fat and carbohydrate content of standard (S) and most approved product (C2)

From fig 3, it is seen that the protein content of the standard (S) was 8.5gram, and the most approved product (C2) was 10.2 gram, respectively. Product S is the standard recipe having soybean chenna as the only source of protein. In the most approved product, C2, apart from soybean chenna (43.2gm/100gm), watermelon seeds (34.1gm/100gm), pumpkin seeds (24.3gm/100gm) and dates are added to improve the protein content of the approved product.[11]Soybean protein contains all amino acids essential to human nutrition, which makes soy products almost equivalent to animal sources in protein quality but with less saturated fat and no cholesterol.[19] Furthermore, watermelon seed is high in citrulline, and arginine, and pumpkin seeds are a good source of L- tryptophan, which reduces depression and also aids in sleeping by conversion to serotonin, thereby beneficial for geriatrics.[18] In old age, there is a substantial reduction in physiologic proteins such as organ tissue, blood components, and immune bodies, which contributes to impaired wound healing, loss of skin elasticity, and also inability to fight infection. Therefore, improvising the protein content in the product is beneficial for the elderly.

The total carbohydrate content of product standard (S) and the most approved product was 21.5gram and 25 grams, respectively. The carbohydrate content of the most approved product was more as the sugar in the standard product is replaced with dates syrup. Dates are ideal fruits to substitute added sugar in foods as the sugar in dates is easily digested and metabolized to release energy for various cellular activities. Dates are also rich in dietary fiber (8.1-12.7%/100gm), phenolic compounds, minerals, vitamins, and antioxidant compounds. [2] The presence of insoluble fibers such as cellulose, hemicellulose, pectin, and lignins in dates further reduces the chances of bowel cancer and regulates bowel movement in older people.[21]

The standard (S) and most approved (C2) have 9.5 grams and 14.6 grams of fat content per 100gms. Fat percentage is an imperative constituent of the sweets as it gives a better texture to the finished product and also improves the flavor and taste. The fat content of the most approved was more when compared to the standard due to the addition of watermelon seed and pumpkin seeds. Soybean has low saturated fat content with a high amount of polyunsaturated fat and is a readily available source of essential fatty acids. [19] Pumpkin seeds are one of the best sources of plant-based omega-3 (alpha-linolenic acid) fatty acids, which helps to lower total as well as LDL-c and increase HDL-c levels in the blood.[5] Fat provides energy and assists the absorption of essential nutrients such as vitamins A, D, E, K, and carotenoids. The ingredient added in Sandesh contains monounsaturated and polyunsaturated fats, which reduce the risk of heart diseases owing to the anti-inflammatory property and cholesterol-lowering effect, which is beneficial for the elderly population.

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c) *Mineral estimation of standard (S) and most approved product (C2)*

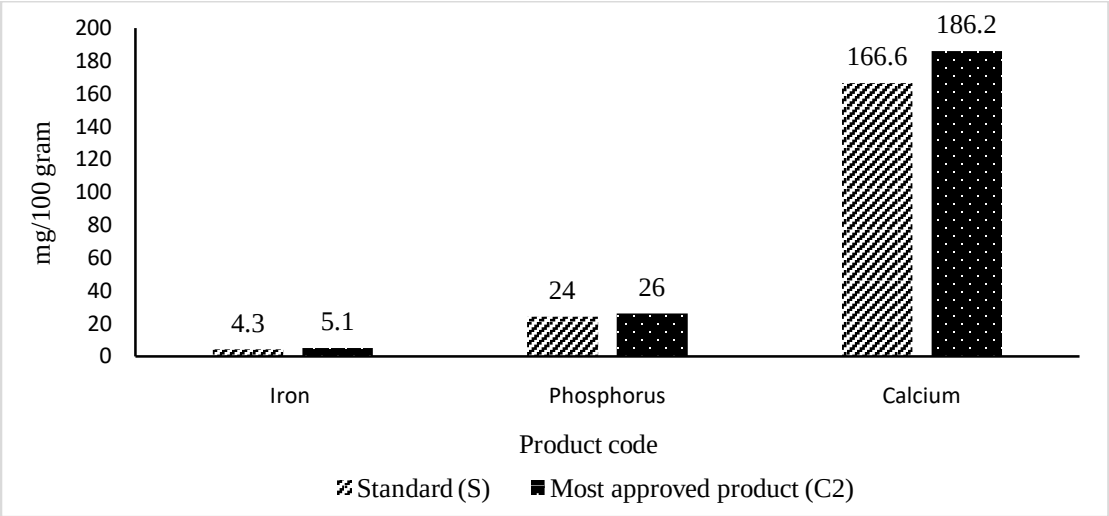


Figure 4: Comparison of iron, phosphorus and calcium content of the standard (S) and most approved product (C2)

Fig 4 denotes that the iron content of standard (S) and most approved (C2) was 4.3 mg and 5.1 mg per 100 grams, respectively. An increase in the iron content can be due to the addition of dates (1mg/100mg), pumpkin seed (5.5mg/100mg), and watermelon seed (7.4mg/100mg). Iron deficiency anemia is prevalent in old age, particularly after the age of 80. [11]There is also a decline in serum ferritin concentrations observed in the elderly. The iron from soybean ferritin helps to prevent the risk of anemia in old age and prevention of undesirable health outcomes, including increased susceptibility to fall and depression.[1]Dates also contain thiamine, riboflavin, niacin, and pantothenic acid, which help the body in haemoglobinsynthesis. [24]

The calcium content of standard (S) and most approved (C2) was 166.6mg and 186.2mg, respectively. The calcium content of the most approved (C2) was more due to the addition of functional ingredients such as dates, pumpkin seeds, and watermelon seed. 100g of dates, pumpkin seed, and watermelon seed contains 22mg, 50mg, and 100mg of calcium, respectively.[11] Calcium helps to ease insomnia and also helps regulate the passage of nutrients through cell walls. Diet deficient in calcium can result in the uptake of calcium from the bones leading to bone resorption. To absorb calcium, nutrients such as magnesium and copper is required, which aids in bone formation. Soymilk contains 12 times the amount of copper and 42 times the amount of manganese as compared to cow milk, which is essential for bone formation. The soy isoflavones, daidzein and genistein, directly hinder bone resorption thereby, reducing the risk of osteoporosis in the elderly population. [20] Furthermore, watermelon seed contains substantial amounts of lysine, which plays a vital role in calcium absorption and the formation of collagen and connective tissue in the body. Moreover, pumpkin seeds contain a considerable amount of zinc, which acts as a natural protector against osteoporosis since zinc deficiencies can lead to higher rates of osteoporosis development. [7]

The result obtained in the study shows the phosphorus content of the standard (S) and most approved variations (C2) as 24mg and 26mg, respectively. The phosphorus content of the most approved was more due to the addition of pumpkin seed and watermelon seed. 100 g of pumpkin seed and watermelon seed contains 830mg and 937mg of phosphorus.[11]Soybean contains phosphorus, which help to strengthen teeth and prevent nerve disorder. It was reported that soybean consumption on a regular basis delays the aging process. [14]

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d) Total antioxidant analysis by DPPH method

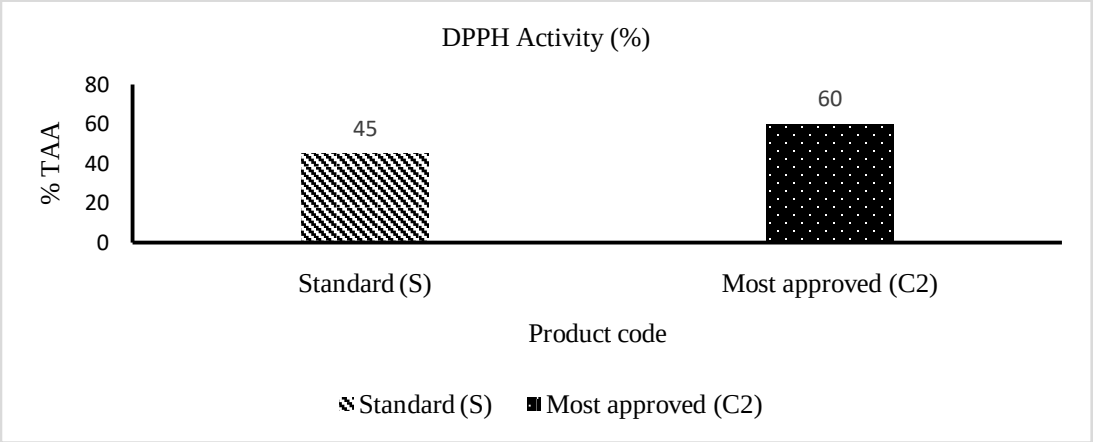


Figure 5: Comparison of total antioxidant activity of standard (S) and most approved (C2)

From figure no 5, it is seen that the total antioxidant activity of the standard and most approved one was 45% and 60%, respectively. In old age. inflammation is predominant, which in turn increases the formation of free radical in the body leading to several chronic and life-threatening diseases and health problems including heart disease, cancer, immune dysfunction, diabetes, and degenerative brain disorders (including dementia and Alzheimer's disease). Antioxidants are known to quench free radicals, thus are essential components of the anti-aging formulation. [13]Consumption of the pumpkin seed and watermelon seed reduces the risk of getting cardiovascular diseases and cancers due to the substantial amount of total phenols and vitamin E present.[22] Dates have the highest concentration of polyphenols (3942 mg/100g) among dried fruits.[25]The antioxidant activity of phenolic compounds is a result of their redox properties, which play an essential role in absorbing and neutralizing free radicals.

IV. Conclusion

Sandesh is a very famous dessert in eastern parts of India and forms part and parcel of social life, ceremonies, and festivals and is enjoyed by all. Soybean protein is considered to be a good dietary protein alternative compared to animal protein in terms of quality of amino acid profile and cost effectiveness. Dates are also considered as an ideal food for the elderly because it provides a wide range of essential nutrients with many potential health benefits. Furthermore, pumpkin seeds and watermelon seeds are a powerhouse of a concentrated sources of iron, zinc, magnesium, B-vitamins, and other phytochemicals. Therefore, the substitution of the traditional cow's milk chenna with soy milk chenna and fortification with pumpkin seeds and watermelon seeds can prove beneficial for the overall health of the elderly population and also reduce the risk of morbidity and improve quality of life.

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By Saiful Bakri & Wiqayatun Khazanah

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Keywords: *cork fish extract, and hypoalbumin pain.*

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Effectiveness of Giving Cork Fish Extracts to Increasing Albumin Levels of Hypoalbumin Patients in RSUD Dr. Zainoel Abidin

Saiful Bakri [α] & Wiqayatun Khazanah [σ]

Abstract- Albumin is used as the best predictor of healing patients and is one of the important parameters in measuring nutritional status in patients with acute or chronic diseases. Giving food therapy, a source of protein albumin serves to increase albumin in the blood to be good so that the patient becomes healthy faster so that the period of care or length of stay in the hospital becomes shorter. This research aimed at observing the effect of giving cork fish extracts to the patient's hypoalbuminemia at General Hospital of Dr. Zainoel Abidin (RSU-ZA) Banda Aceh. This research is an experimental pre-test posttest one group design. Initial examination is examining the albumin levels in patients with hypoalbuminemia, then given 100 ml cork fish extract. Therapy for administration was conducted for 7 days then re-examined the levels of albumin. The sample was taken by purposive sampling. The results indicated that: blood albumin levels in patients with hypoalbuminemia, the mean initial blood albumin level in the total subjects was 2.79 ± 0.16gr / dl with values ranging from 2.52 - 2.99 gr / dl, whereas according to sex in male sex subjects male albumin levels were not significantly different (2.79 ± 0.16 gr / dl) and (2.78 ± 0.19gr / dl), this indicates that early albumin levels in both males and females had levels of same blood albumin. Conclusion: Blood albumin level in patients with hypoalbuminemia before being given cork fish extract 2.79gr / dl and after being given cork fish extract 2.97gr / dl. There is an effect of giving cork fish extract to increasing blood albumin levels in patients with hypoalbuminemia. The level of albumin increased by 0.31 gr / dl by consuming cork fish extract 3 times a day in one week.

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I. Introduction

Albumin is a protein in human plasma that dissolves in water and settles in heating and the highest concentration of protein in blood plasma1. The function of albumin includes maintaining oncotic pressure, carrying thyroid hormones, fatty acids, bilirubin, drugs and as an acute phase inflammatory protein, as the body's immune response to infection, so albumin plays an important role in the healing process2. Low albumin levels slow down the body's immune response in facing of infection so that the healing process becomes too late. Therefore, inadequate nutrition will slow the healing process of patients3.

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In hypoalbuminemia patients the levels of albumin in their blood have decreased. This is because albumin can dissolve during the surgical process or while healing the patient. This is because albumin which was previously produced in the endoplasmic reticulum of the liver in extravascular distribution in the skin and muscle tissue is much wasted due to various diseases4. These patients with hypoalbumin do not immediately get good treatment which will cause various problems. Patients with low blood albumin levels have a long risk of recovery and can cause various risks of infection5. Longer stays will add to various problems. In addition to nosocomial infections that might occur, in terms of costs that must be borne by patients will also increase. In addition, in terms of psychology, patients who do not recover will make patients and families panic and worry, which in turn will also cause various problems6.

To increase albumin levels in blood in hypoalbuminemia patients can be done by therapy of foods that are high in albumin content both in the form of food formulas originating from manufacturers (commercial formulas) or obtained naturally7. Cork fish is a food source that is obtained from natural products and has a very good nutrient content for the body. Cork fish contains albumin which is one of the proalbumin proteins. Proalbumin is a basic substance that forms albumin compounds. Giving cork fish or protein extract can increase albumin levels in the blood and help cure patients. Giving 2 kg of cork fish to cook every day to patients will increase their albumin to normal. The administration of cork fish extract for 10-14 days showed an increase in albumin up to 0.6 to 0.8 g / dl8.

Although other fish are also known as a good source of protein for the body, cork fish are known to have a higher type of nutrient content. The protein content of cork fish is 25.5%, higher than the protein content of milkfish (20.0%), carp (16.0%), snapper (20.0%), and sardines (21, 1%) 9.

Therefore, a study is needed to see the effectiveness of cork fish extract to increase albumin levels in the blood in hypoalbuminemia patients. The effort to provide food therapy, a source of protein for albumin, functions to increase albumin in the blood so that patients become healthy faster so that the length of staying in hospital is shorter.

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II. Research Methods

a) Place Design and Time of Research

This type of research is an experimental pre-test posttest one group design. In this study an initial and final examination of albumin levels was carried out in patients with hypoalbuminemia, and then 100 ml of cork fish extract was given. Therapeutic administration was done for 7 days then re-examined the albumin level10.

The study was conducted at the Zainoel Abidin General Hospital in Banda Aceh for 3 months, namely from July to September 2018. The population in this study was all patients who experienced hypoalbuminemia during the study. The subjects in this study were taken by purposive sampling with the following conditions:

a. Patients hospitalized
b. Patients with good awareness and getting oral food.
c. Do not get albumin infusion through a vein.

b) Data Analysis

Univariate analysis used to find a descriptive of the data collected especially basic data about the mean, median, standard deviation, and albumin levels.

Bivariate analysis was carried out to see differences in initial hemoglobin levels, final hemoglobin and changes in blood albumin levels before and after intervention in the form of cork fish extract using Paired T-test. The normality test for the initial albumin level data, the final albumin level was carried out using the Kolmogorov-Smirnov test.

III. Results and Discussion

a) Characteristics of Subjects

The results of data collection, subjects were male sex (72%) than women (28%). To be clearer can be seen in Figure 2. It shows that the average of the subject's age is 55 years with the lowest 27 years and the highest is 88 years. If seen by sex, the average age of the male sex subject is 58 years, which is distributed from the lowest age of 27 years and the highest is 88 years. Whereas in the female group, the average age is 47 years, which are distributed from the age of 33 years to 70 years.

For the distribution of the age group most subjects are in the group 41 - 50 years and 51 - 60 years and the lowest is in the age group 20-30 and 71 - 80 years, to be clearer.

Analysis of the Results of Measurement of Blood Albumin Levels

The results of examination of blood albumin levels in patients with hypoalbuminemia, the mean initial blood albumin levels in the total subjects were 2, 79 ± 0.16 gr / dl with values ranging from 2.52 - 2.99 gr / dl, whereas according to gender in male sex subjects there was no significant difference in albumin levels (2.79 ± 0.16 gr / dl) and (2.78 ± 0.19gr / dl), indicating that the initial albumin levels in both men and women had the same blood albumin levels.

Table 1: Mean Distribution of Blood Albumin Levels by Subject Group

Blood Specimen	Average ± of Standard Deviation (gr/dl)		
	Male	Female	Total of the sample
Initial Albumin	2,79 ± 0,16	2,78 ± 0,19	2,79 ± 0,16
Final Albumin	3,02 ± 0,32	2,87 ± 0,28	2,97 ± 0,31

While the results of examination of blood albumin levels in patients with hypoalbuminemia after intervention, the mean final blood albumin level in the total subjects was 2.97 ± 0.31gr / dl with a range of 2.42 - 3.73 gr / dl, whereas according to gender on the subject male albumin levels were slightly higher levels (3.02 ± 0.32gr / dl) compared to women (2.87 ± 0.29 gr / dl). However, it is not much different from the average albumin level overall of the total subjects and has a tendency to increase albumin levels in both men and women after intervention.

b) Analysis of Research Results Levels of Intervention Group Albumin

Table 3: Mean Distribution of Blood Albumin Levels (gr / dl) Intervention Group

Blood Albumin	Mean	SD	95% CI	*Mean difference*	*P. value*
Initial Inspection	2,79	0,16	0,07-0,27	0,42	0,001
Final Inspection	2,97	0,30			

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Distribution of blood albumin levels in the intervention group between before and after intervention in patients with hypoalbuminemia.

Based on table 1. the results of examination of the subject's serum albumin levels in both male and female at the ZainoelAbidin General Hospital in Banda Aceh had albumin levels below the normal value (<3.5 gr / dl) which was an average value of 2.79 ± 0.15 gr / dl. Hypoalbumin is an albumin level that is low or below the normal value or a condition where the serum albumin level is <3.5 g / dl. Hypoalbumin reflects an inadequate supply of amino acids from proteins, thus interfering with the synthesis of albumin and other proteins by the liver. The results showed that all of the respondents had less albumin levels at the beginning of the examination in both male sex (2.79 ± 0.16 gr / dl) and in women (2.78 ± 0.19 gr / dl). Lack of albumin levels experienced by the subject, will be a problem if no immediate action is taken because the immune response in the body will be reduced so that it can slow healing and will facilitate the emergence of other infectious diseases. Albumin has an important role as a carrier of certain chemicals including drugs through the system circulation, transporting a variety of insoluble material in water (bilirubin, fatty acids, and several types of hormones), maintaining plasma oncotic pressure, as the body's defense (control and antioxidant functions), helping metabolize nutrients and accelerating cell tissue recovery.

One way to increase the amount of albumin in the body is by consuming foods high in protein. Extreme fish cork is a food that contains a lot of albumin. Albumin itself is one of the elements of protein which has the character as proalbumin. Proalbumin is a basic constituent of albumin compounds. So, by consuming cork fish extract, it can increase the amount of albumin in the liver. In table 2 shows the mean blood albumin concentration given cork fish extract increased blood albumin levels from (2.79 ± 0.16 gr / dl), to (2.97 ± 0.30 gr / dl).

In this study it was proven that cork fish extract can increase blood albumin levels in patients with hypoalbuminemia. Biochemically there was an increase in albumin of 0.42 mg / dl by consuming 150 ml of cork fish extract a day in one week at the hospital. Besides being easily obtained, consuming cork fish extracts also saves costs compared to using transfusion / infusion albumin at a much higher price. This result is in line with the results of a study by samsiatun NH and female students in 2015, namely the addition of cork fish extract juice to albumin and Hb levels in patients with hypoalbuminemia p> 0.002. Giving cork fish extract for a week can increase blood albumin levels by 0.52 gr / dl in patients with hypoalbuminemia9

This study supports previous research (Prastowo, et al. 2014) which states that the results of this study indicate that patients with pulmonary TB with hypoalbumin supplementation of cork fish extract can increase serum albumin levels and cork fish extract can also be used to increase the healing power of patients with hypoalbumin. Nutritional factors such as low food intake, anorexia and increased catabolism are the causes of a decrease in the patient's albumin levels. Giving foods containing proteins with high biological values increases albumin levels. Provision of cork fish containing prelbumin can increase albumin levels in the blood11.

IV. Conclusions

1. Blood albumin level in patients with hypoalbuminemia before being given cork fish extract is 2.79gr / dl.
2. Blood albumin level in patients with hypoalbuminemia after being given cork fish extract is 2.97gr / dl.
3. There is an effect of giving cork fish extract to increasing blood albumin levels in patients with hypoalbuminemia at RSU-ZA Banda Aceh. Increase in albumin by 0.31 gr / dl by consuming cork fish extract 3 times a day in one week.

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- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.



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Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Medical Research Paper

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of medical research then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.



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Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



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Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

A

Aliquot · 39, 41
Appetite · 36

C

Ceased · 1, 5
Consumption · 1, 4, 5, 6, 8, 10, 11, 12, 14, 44
Craving · 36

D

Decantation · 39

G

Geriatrics · 36, 42

H

Hedonic · 39, 41

I

Insomnia · 43

O

Osteoporosis · 36, 43, 44

P

Pantothenic · 43

Q

Quench · 45

R

Reagents · 40

S

Scavenging · 41

U

Unripened · 36, 37

V

Vigorously · 39





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