Research article

The relationship between breakfast behaviour and Body Mass Index (BMI) – a randomized clinical trial

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ABSTRACT

Breakfast is a meal eaten in the morning and at the first of the day. Failure to eat a well-balanced diet in the morning has been documented to have a deleterious impact on the health such as nutritional disorders, non-communicable diseases and failure to cognitive performance. Ayurveda texts mentioned that consuming food in the morning enhance memory power, life span, energy, complexion, and lustre. The objective of the present study was to study the relationship between breakfast and BMI values. Fifty cases of male and female, between 20 and 60 years were randomly selected from OPD in Ayurveda Teaching Hospital, Borella, Sri Lanka. The relationship between breakfasts with BMI was evaluated. Socio-demographic characteristics such as age, gender, religion, ethnicity, occupation, monthly income, residential area and education were gathered through a questionnaire. BMI was measured and that was compared with information related to breakfast as a morning drink, type of food consumption, skipping breakfast, veg food habits and time having breakfast. Statistical analyses were performed using SPSS, version 17.0. Mean age of the study population was 42 years in which 58% were females. According to BMI values, 6% underweight, 42% normal weight and 52% were overweight respectively. When comparing breakfast habits with BMI categories, there was no significant relationship with milk as a morning drink, rice and curry as a morning diet, vegetarian food, skipping breakfast ($p>0.05$). Consumption of tea as a morning drink which was significantly related with BMI values ($p=0.023$) as well as taking refined wheat flour product as a morning diet, having breakfast at 6.00 am to 9.00 am were significantly related with BMI ($p=0.017$ and $p=0.020$, respectively). The study indicated that the drinking tea, consumption of refined wheat flour product and time of the taking breakfast were significantly related with BMI.

INTRODUCTION

Breakfast is a meal eaten in the morning and is taken at the first of the day. The word refers to breaking the fasting period of the prior night. Breakfast is often described as the most important meal of the day, providing as it does sustenance and energy for whatever activities lay ahead. Eat breakfast like a king, lunch like a prince and dinner like a pauper. It should be aiming to consume around 15-25% of daily energy intake at breakfast (300-500 calories for women and 375-625 for men). There is undoubtedly much culture variance in the kind of foods. Different people like to eat at different times. Failure to eat balanced breakfast has been documented to have a deleterious impact on cognitive performance with the academic performance of school-aged children.

Another important fact is cortisol awakening response, especially in humans which has been shown that the secretion of cortisol from the adrenal glands exhibiting a profound increase after awakening (50% increase in cortisol levels on awakening) under normal circumstances, the peak production of cortisol occurs between 8.00 am and 9.00 am and then those who eat breakfast between 6.00 am and 10 am with the peak occurring at around 8.00 am (Spence, 2017). This elevation protects key metabolic functions (e.g. maintaining cerebral glucose supply during starvation).

In the circulation, more than 95% of cortisol is bound to protein, principally cortisol-binding globulin and it is biologically activated via glucocorticoid receptors. It is caused to increase appetite, therefore, better to take breakfast around 8.00 am. Breakfast also makes a large contribution

to daily micronutrient, e.g. iron, vitamin B, vitamin D, etc. (Adolphus et al., 2013). There is a possible association between skipping breakfast and overweight and obesity is globally observed regardless of cultural diversity among countries (Horikawa et al., 2011). In addition, skipping breakfast is related to increasing the risk of coronary heart disease, i.e., a narrowing of the coronary arteries (Cahill et al., 2013).

Breakfast consumption correlates significantly with school adolescents' age, gender as well as parents occupation and education level. Fast food and breakfast consumption is related among adolescents and studied factors affecting that situation are their families, friends' interest, advertisements, the close proximity of a school and home. These unhealthy food habits are considered as risk factors for chronic disease among adolescents and adults (Adolphus et al., 2013). There are dietary and weight advantages by ones that consuming breakfast especially with grains, cereals, lower fat intake and whole fruits (100% fruit juice) than skipping breakfast (O'Neil et al., 2014).

According to Ayurveda text, the concept of optimal health is *Swasthaya* and it has described as one whose *Dosas*, *Agni* and function of *Dhatu* and *Malas* are in the state of equilibrium and who has a cheerful mind, intellect and sense organs is *Swastha* (healthy) (Sharma, 2013). The relationship with health and disease is mentioned in as any disturbance in the equilibrium of *Dhatus* is known as disease and on the other hand, the state of their equilibrium is health. Health and diseases are also defined as pleasure and pain respectively (Sharma, 2014). There are three sub-pillars such as diet, sleep and celibacy. If these are observed properly, the body is supported well by these pillars (Sharma, 2014).

Consuming food provides instant energy and strength and supports body functioning. It enhances memory power, life span, energy, complexion, mental stability and lustre. That is why a human is advised to take food two times a day thoroughly knowing the time, quality and quantity of food. Consuming food in the morning and evening is advised by scriptures. One should not eat before three hours after eating and should not eat fast for more than six hours. In the first three hours digestion will be taking place and after six hours body strength is lost, it does not eat appetite is stimulated when food and *Dosas* are digested. That is why whenever a man perceives appetite that is his food time. If a person does not consume food even when he is hungry, the digestive fire present inside craves for fuel. Food and its absence become less in intensity.

The body fire meant for metabolism starts utilizing *Dosas* and afterword *Dhatus* and then utilizes the life itself. The features of proper digestion are free belching (without emitting any food or its smell) energetic feeling, timely excretion, lightness in the body and development of thirst and appetite (Sitaram, 2012). As there is no scientific validation of relationship between breakfast and Body Mass Index (BMI), hence, the aim of the present work is to validate this relationship.

MATERIALS AND METHODS

Study design

A total of 50 cases from OPD (Outdoor Patient Department) clinics in Ayurveda teaching hospital, Borella were randomly selected. According to breakfast and health, information was collected using a questionnaire. When selecting cases, simple random sampling method was applied. The exclusion criteria were the cases of pregnancy, lactating mothers, age below 20 and over 80 years and severe disease conditions whereas the inclusion criteria were the patients aged between 20 and 80 years of both sexes and interested in taking part in this study.

Method

Various key information including age (20-40, 41-60, 61-80 years), religion (Buddhist, Catholic, Hindu, Islam), ethnicity (Sinhala, Tamil, Muslim), occupation (Government, Private sector, Self-employment, Non employment), residential area (Urban, Rural), sex (male, female), education (primary, secondary, tertiary), socio-economic status (monthly income <5000, 5000-20000, 20000-35000, 35000-50000, > 50000 Sri Lankan Rupees), height (1.3-1.5, 1.5 -1.7, >1.7 m), weight (20-40, 41-60, 61-80, 81-100 kg), morning drink (water, coffee, milk, tea, other), food pattern (vegetarian, non-vegetarian), morning diet (rice and curry, rice flour products, cereal, refined flour products, porridge, fruits), skipping meal (Yes, No), and time (before 6.00 am, 6.00 am to 9.00 am, 9.00 am to 10.00 am), were recorded by using questionnaire. Weight & height of every case were recorded and the BMI (kg/m^2) was calculated accordingly. Then cases were categorized according to the BMI levels as follows.

Category	BMI (kg/m^2)
Underweight	<18.5
Normal range	18.50 - 24.99
Overweight	Above 25

Data analysis

Statistical analyses were performed using SPSS statistical analysis software (version 17.0). Descriptive statistics were used to calculate socio-demographic characteristics and anthropometric measurements. Chi-square tests were used to identify the relationship between breakfast habits and BMI level.

RESULTS

In the present study, as shown in Table 1, females were high in proportion, i.e. 58%. Buddhist (90%) and Sinhalese (96%) were also high. Most of them were unemployed (52%) and family income was Sri Lankan Rupees 20000-50000 (40%). Majority of subjects were living in urban areas (86%) and the education was of secondary level (80%).

Table 1. Frequency distribution of socio-demographic characteristics of the study group

Characteristics	Frequency N=50	Percent
Age in years		
20-40	21	42%
40-60	19	38%
60-80	10	20%
Religion		
Buddhist	45	90%
Catholic	2	04%
Islam	2	04%
Hindu	1	25%
Ethnicity		
Sinhala	48	96%
Muslims	1	02%
Malay	1	02%
Occupation		
Government	10	20%
Private sector	08	16%
Self-employment	06	12%
Non-employment	26	52%
Monthly income (Sri Lankan Rupees)		
<5000	05	10%
5000-20000	09	18%
20000-35000	20	40%
35000-50000	09	18%
>50000	07	14%
Residential area		
Urban	43	86%
Rural	07	14%
Gender		
Male	21	42%
Female	29	58%
Education		
Primary	07	14%
Secondary	40	80%
Tertiary	03	06%

According to anthropometric measurement, as shown in Table 2, most of them are 60-80 kg of weight (50%) and 1.5-1.7 m in height (64%). The majority were included in overweight (above 25 kg/m^2) of BMI level (52%).

Table 2. Frequency distribution of anthropometric measurements in the study group

Measurements	Frequency	Percent
Weight (kg)		
40-60	17	34%
60-80	25	50%
80-100	08	16%
Height (m)		
1.3-1.5	07	14%
1.5-1.7	32	64%
1.7-1.9	11	22%
BMI level (kg/m^2)		
Under weight	03	06%
Normal weight	21	42%
Overweight	26	52%

BMI (Body Mass Index); underweight (BMI <18.5 kg/m^2); normal weight (BMI 18.5-24.99 kg/m^2); over weight (>25 kg/m^2)

The results as shown in Table 3 revealed that 6% of patients were found underweight, 42% were normal whereas 52% were found as overweight. The females were found more pronged to overweight (65.38%) among the overweight population.

Table 3. Frequency distribution of body mass index in the study group

BMI	Male	Percentage	Female	Percentage	Total	Percentage
Under weight	2	66.66%	1	33.33%	3	6%
Normal weight	10	47.62%	11	52.38%	21	42%
Over weight	9	34.62%	17	65.38%	26	52%
Total	21		29		50	100%

Table 4. Frequency distribution of diet habits of breakfast

Diet habits	Frequency (N=50)		Percentage	
	Yes	No	Yes	No
Morning drink				
Water	20	30	40%	60%
Coffee	49	01	98%	02%
Milk	34	16	68%	32%
Tea	10	40	20%	80%
Any other	02	48	04%	96%
Morning diet				
Rice and curry	43	07	86%	14%
Rice flour product	08	42	16%	84%
Cereal	09	41	18%	82%
Refined wheat flour product	08	42	16%	84%
Porridge	03	47	06%	94%
Fruit	01	49	02%	98%
Skipping meal	09	41	18%	82%

Food pattern				
Vegetarian	02	48	04%	96%
Time				
6.00 - 9.00 am	39	11	78%	22%
9.00 - 12.00 am	11	39	22%	78%

The results from Table 4 showed that a total of 68% of subjects were taking milk as a morning drink which was found non-significant with the BMI levels. However, the respondents who were taking tea as morning drink were found significant with the BMI levels (p=0.023) (Table 5; Figure 1).

Table 5. Chi-square test of BMI & breakfast habits

| Breakfast habits	Pearson chi-square value	Df	p-value
Morning drink			
Water	2.129[a]	2	0.345
Coffee	.942[a]	2	0.624
Milk	2.091[a]	2	0.351
Tea	7.509[a]	2	**0.023**
Other	1.923[a]	2	0.382
Morning diet			
Rice and curry	1.429[a]	2	0.490
Rice flour product	0.724[a]	2	0.696
Cereal	1.954[a]	2	0.376
Refined wheat flour product	8.123[a]	2	**0.017**
Porridge	0.381[a]	2	0.827
Fruit	1.401[a]	2	0.494
Skipping meal	0.701[a]	2	0.704
Food pattern			
Vegetarian	2.871[a]	2	0.237
Time	5.675[a]	2	0.020
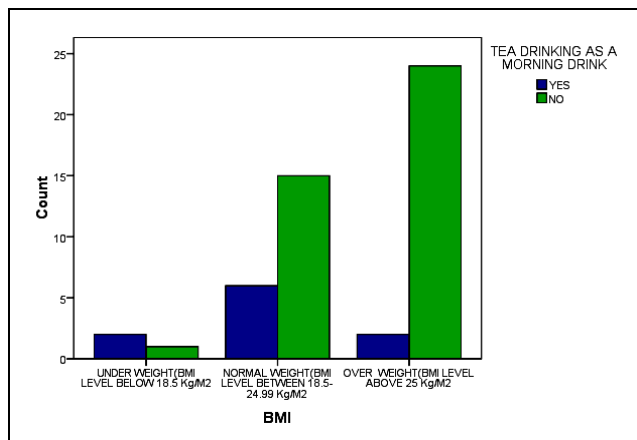
Figure 1. The relationship between the tea as a morning drink and BMI level

Most of them were non-vegetarian and the value was not significant with BMI levels. In addition, water or coffee as a morning drink was found non-significant with BMI. The rice and curry were found as the most used morning diets. The rice flour product, cereals, porridge, and fruits

diets were also found non-significant with BMI whereas the diet of refined wheat flour product (8%) was found significant (p=0.0170) (Figure 2). In the present study, 41% of subjects were recorded having a regular habit of breakfast while only 9% were skipping their breakfast. According to the statistical analysis, there was no association between skipping breakfast and BMI levels. Most of them were taking breakfast at 6.00-9.00 am. Time of taking first meal of the day has an association with the BMI level (p=0.020) (Figure 3). All the figures were determined by CROSSTABS using SPSS software (version 17.0).
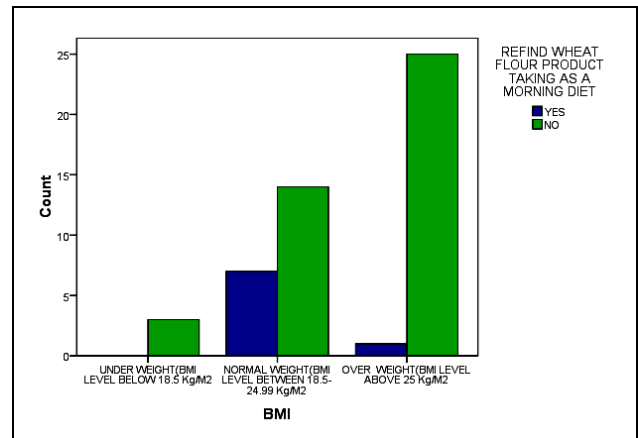

Figure 2. A relationship between the refined wheat flour product as a morning diet and BMI level
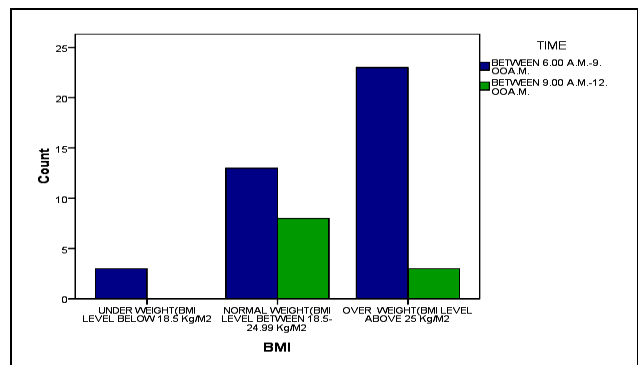

Figure 3. A relationship between the time of taking the first meal of the day and BMI level

DISCUSSION

In the present study, the share of the respondents who were not taking tea as morning drink was 80%, which was significant with BMI levels (p=0.023). According to a large and cross-sectional survey conducted by National Center for Health Statistics in United State, the hot tea consumption is inversely associated with obesity as the tea consumers had lower mean waist circumference and lower BMI (p<0.001) than non-consumers. For iced tea consumption, the association was reversed. Increased iced tea consumption was associated with higher BMI, greater waist circumference, and greater

subcutaneous skinfold thickness (Vernarelli and Lambert, 2013). In the present study, milk consumption was non-significant with BMI levels. Previously, researchers have found a significant inverse relationship between milk consumption and BMI for females, but not for males (Potter, 2015). A cross-sectional population-based survey conducted in Krakow, Poland suggested that coffee consumption is inversely associated with BMI levels (Grosso et al., 2015). However, in the present study, the coffee consumption was found non-significant with BMI levels.

In addition, the water taking as a morning drink was non-significant in this study but the previous study found that the pre-meal water consumption reduced meal energy intake in overweight and obese older adults (Davy et al., 2008). In this study, most of the subjects were found as non-vegetarian and non-significant with BMI. However, in the previous study, the BMI was highest in non-vegetarian and lowest in strict vegetarians (Rizzo et al., 2013). Majority of them were taking rice and curry as a morning diet. It is not significant with BMI levels as well as rice flour product, cereals, porridge, and fruits.

In the previous study, there was a significant association between rice consumption and obesity as well as diet quality indices among Iranian adolescents (Azadbakht et al., 2016). Also, some studies identified that lower BMI and waist circumferences were advantages of consuming grains, cereals, lower fat milk, and whole fruit/fruit juices especially in breakfast (O'Neil et al., 2014). Correlation analysis showed that for adults living in the urban areas in China, the daily intake of rice and its products, wheat flour and its products was positively correlated with BMI (Zou et al., 2015).

In the present study, there was an association between skipping breakfast and overweight and obesity (Horikawa et al., 2011). However, Lee et al. (2016) identified that the habit of eating breakfast is associated with lower risk of hypertension among healthy Korean adults. The previous study also found the risk of overweight and obesity in the subjects taking breakfast at late morning (9.00-11.30 am) as compared to the early morning (5.00-8.59 am) (Virani, 2016).

CONCLUSION

The present study showed how breakfast habits are important contributors to BMI and it reflects the health status of the study population to a certain extent. Finally, the study indicated that the drinking tea, consumption of refined wheat flour product and time of the taking breakfast were significantly related with the BMI. Therefore, the habit of breakfast was associated with BMI significantly. This study did not assess all confounding factors, although there was an attempt to include as many as possible anthropometric measurements, socio-demographic characteristics, and breakfast habits.

Further, large scale studies are needed to confirm the possible effect of regular breakfast consumption on health and identify the associated factors.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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