

Barley Based Bread may Suppress the Appetite in Individuals who Practice Islamic Fasting

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Abstract

Background: Fasting is one of the main worships of Islam. One of the main complaint of individuals fasting is the feeling of hunger and because of the consumption of bread as the staple food of most Muslims, it influences the appetite and satiety of fasting individuals. The objective of this study was to investigate the effect of barley bread on appetite and satiety compared with white wheat bread in healthy fasting participants.

Methods and Materials: This study was a clinical trial performed for 3 consecutive days during Itikaf ceremony. Demographic and anthropometric characteristics of healthy participants were assessed. 24 hours dietary recall used for dietary intakes. To measure appetite and satiety, FLINT visual analogue scale was used.

Results: 184 healthy men and women in Itikaf fasting participated in this study. The results showed that during the fasting period, hunger in the barley bread group was significantly lower than white wheat bread group. Rate of hunger before the Iftar in the barley bread group was significantly lower than wheat bread group. During the time, the sense of hunger decreased before the Sahur in the barley group, but its trend was not statistically significant. During the fasting period, the highest reduction in satiety was observed in the first five hours of fasting, which did not differ significantly between the two groups. Satiety was increased before the Sahur in the barley group, but its trend was not statistically significant.

Conclusion: This study show that barley bread decreased appetite and increased satiety during the fasting compared with wheat bread.

Keywords: Barley; Bread; Fasting; Wheat bread; Appetite; Satiety

Introduction

Fasting is one of the main worships of Islam which healthy able Muslims abstain from drinking, eating, medications and smoking during the day [1]. Fasting begins after Sahur, a meal before sunrise, and is completed after Iftar, another meal after sunset which usually begins with consuming dates or sweetened water and followed by other foods [2].

Thus, during this fasting there are changes in eating pattern, timings and frequency of meals, and quality of foods [3,4]. Islamic fasting could last for 8 to 18 hours based on the geographical location and season [3].

Itikaf, according to Islam orders, means seclusion and retiring for a specific time into a mosque for devotion, with the intention of becoming nearer to Allah. Itikaf can be done at any time, but the best time for Itikaf is the last ten days of Ramadan [5] and 13, 14 and 15th of Rajab month. However, people in Itikaf spend most of their time doing worships.

One of the main complaint of individuals while fasting is the feeling of hunger and because of the consumption of bread as the staple food of most Muslims, it influences the appetite and satiety of fasting individuals. Different types of bread such as chickpea [6], white, whole meal wheat, barley, oat and Seeds are consumed as the staple food by most people in their meals [7] and their effects on satiety has been investigated by many researchers [8,9]. According to the studies, foods that contain barley have lower glycemic index compared to white wheat bread (WWB) and may exert more significant satiety effects [10,11].

Barley is a high-fiber grain that contains significant levels of both

soluble and insoluble fiber and it is also classified as a grain with low glycemic index. The type of starch and type and amount of fiber can elicit a low postprandial glycemic response. Barely has several food products, including bread, pasta, tortillas, noodles, biscuits and chips [12]. Also barely is consist of soluble fiber such as β -glucan, and it can improve glycemic control [12,13].

Existent evidence indicated the role of barely bread on the appetite and satiety sensation. One study compared barley kernel bread with white wheat bread (WWB) on three days and this study showed that barley bread increased levels of PYY, GLP-1, and GLP-2 (18). Another study showed an evening meal containing barley kernel can facilitate the regulation of glucose, amplify GLP-1 release, decrease the subsequent energy intake and reduce hunger over two consecutive meals [11]. To best of our knowledge there is no study about the role of barley bread on the satiety in the fasting. The aim of the present study is assessing the effect of barley bread on the appetite and satiety in the fasting.

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Methods

Study setting

This study performed 11 to 13th of April (13 to 15th of Rajab) 2017, for 3 consecutive days. All the participants stayed in Ferdowsi university grand mosque, Mashhad, Iran. This study approved by Mashhad University of Medical Sciences ethics committee (code: IR.MUMS.fm.REC.1396.458) 3 days shows the short time outcomes on satiety and appetite. On the other hand, long term effects of fasting such as hormonal modification as the confounding factor, would not affect the results [12-18].

Participants

University students and staff participated in this study. The inclusion criteria were BMI¹ between 18.5 to 29.9 kilograms/meter² with no report of history of disease such as chronic heart failure, chronic renal failure, hypertension or cirrhosis and filling the consent.

Data collection

Demographic data was collected by questionnaire, and weight, height, waist circumference, blood pressure and pulse rate was measured. Blood pressure and pulse rate were repeated at the end of the study. Participants randomly allocated to two groups. The first group received barley bread and the second had white wheat bread (WWB) along with other foods in Sahur and Iftar. Also, the amount of dietary intake was collected in all 3 days by food records questionnaire (A controlled feeding study).

Hunger assessment

The hunger was assessed 8 times a day including immediately before and after Iftar and Sahur, 5 and 10 hours after Sahur and 2 and 4 hours after Iftar. We used Flint visual analogue scale for hunger assessment which is 100 mm self-rating visual analog scales (VAS) [19]. The first question was "How hungry do you feel?" and VAS was defined as the zero was "I am not hungry at all" and 100 was "I have never been hungrier"; which particularly shows the appetite changes.

Diet design

The meals prepared for fasting people were similar; although they could bring some snacks with themselves and it is considered in 24-hour food records filled by participants.

The first group received barley bread and the second had white wheat bread (WWB). 1 loaf of bread was served in Sahur as rice was the staple and 3 loaf of bread in Iftar during 3 consecutive days. Each loaf of bread weighed 60 grams (two portions). After organoleptic tests and technical evaluation of possibility for bread preparation using different ratios of barley flour and white flour (without bran), 70% of barley flour and 30% of wheat flour were selected for preparation of barley bread.

Statistical analysis

We analyzed all data by means of SPSS software version 16 (SPSS, Inc., Chicago, IL, USA). We used the Kolmogrov-Smirnov test to examine the normal distribution of variables. Log transformation was conducted for non-normally distributed variables. Independent-samples t-test was applied for homogeneity of general characteristics, anthropometric measurements, and dietary intakes in two groups. We used paired samples t-test to assess the effects of barley bread and wheat

bread on appetite and anthropometric measurements for normal data and applied mann whitney test for nonparametric data. To compare the changes between groups, we applied independent-samples t-test in normal data and applied wilcoxon test for nonparametric data. We adjusted these variables by using Analysis of covariance (ANCOVA) to obtain independent effect of barley and wheat bread on appetite. P-value<0.05 was considered as significant level.

Results

The baseline characteristics of participant such as age, sex, married status, smoking, heart rate, systolic and diastolic blood pressure, anthropometric indices (weight, height, body mass index, waist circumference) was not significantly different (p value>0.05) (Table 1).

In this study the macronutrients, fluid and caffeine intake was not significantly different between barley bread and wheat bread groups (p value>0.05) (Table 2).

Hunger

Fasting duration was 15 hours a day during this study. Figure 1 has shown the rate of hunger adjusted based on energy intake during the fasting period. During the fasting period, hunger in the barley bread group was significantly lower than wheat bread group (P value<0.001). During this time, the highest increase in hunger was observed in the first five hours of fasting, which is significantly lower in barley bread group than bread wheat group (P value=0.001).

There was a significant decrease in hunger in the bread wheat group (P value=0.006), while this trend was not significant in barley bread group (P value=0.23) (Figure 1).

The rate of adjusted hunger base of energy intake before the Iftar was shown in Figure 2.

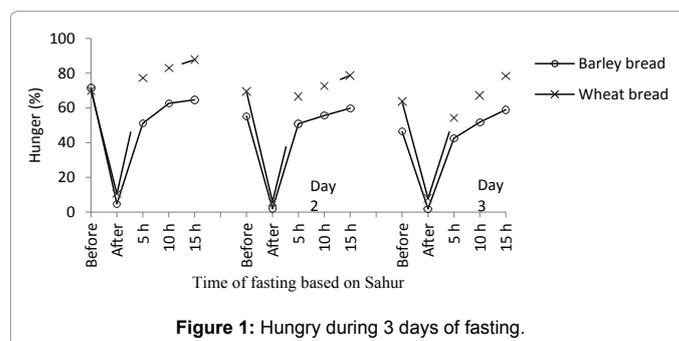


Figure 1: Hungry during 3 days of fasting.

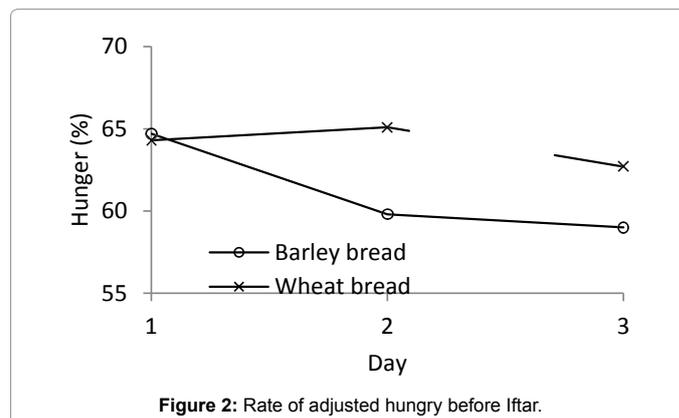


Figure 2: Rate of adjusted hungry before Iftar.

¹ Body mass index

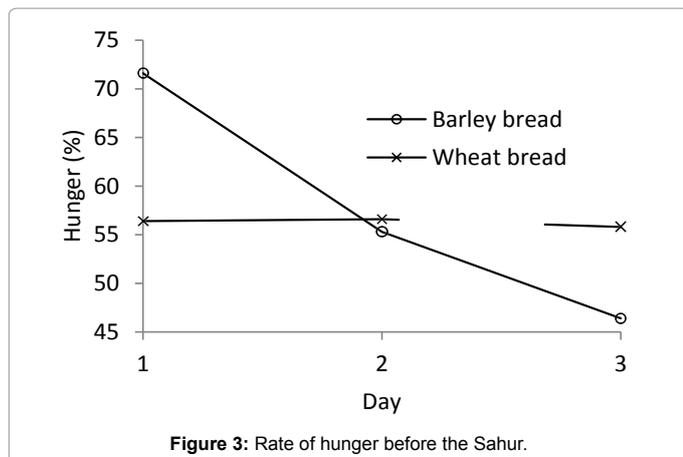


Figure 3: Rate of hunger before the Sahur.

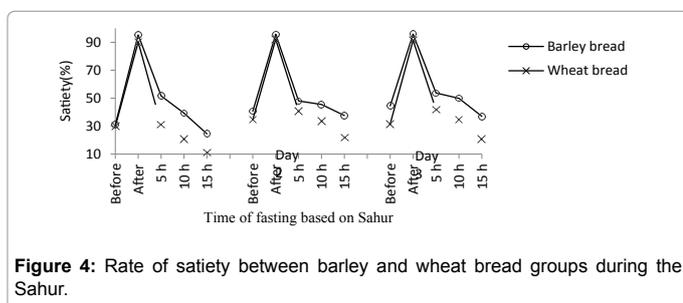


Figure 4: Rate of satiety between barley and wheat bread groups during the Sahur.

The results showed that rate of hunger before Iftar in the barley bread group is significantly lower than wheat bread group (P value<0.001).

However, in the both groups, the sense of hunger before the Iftar over time had a significant reduction (p value = 0.02 and bread wheat P value=0.01).

The rate of adjusted hunger based on energy intake before the Sahur is shown in Figure 3. The results show that there is no significant difference between barley and wheat bread in the sense of hunger before the Sahur (P value>0.05). As shown in Figure 3, during the time the sense of hunger decreased before the Sahur in the barley group, but this trend was not statistically significant (P value=0.4) (Figure 3).

Satiety

The diagram showed the trend of adjusted sense of satiety based on energy intake during the fasting period (Figure 4). During of the fasting time, sense of satiety in the barley bread group is higher in comparison to the wheat bread group (P value<0.001). During the fasting period, the highest reduction in satiety was observed in the first five hours of fasting (P value=0.001), which did not differ significantly between the two groups (P value>0.05).

The rate of satiety sense adjusted based on energy intake before the Iftar was shown in Figure 5. The results show that there is no significant difference between barley and wheat bread groups in the sense of satiety before the Iftar (P value=0.05).

As shown in Figure 6, over the course of time, satiety was increased before the Sahur in the barley group, but this trend was not statistically significant (P value=0.7).

Desire to eat

The diagram showed the trend of adjusted desire to eat based on

energy intake during the fasting period (Figure 7). During the fasting period, the desire to eat in the barley group was significantly lower than wheat bread group (P value<0.001). During the fasting time, the highest increase in desire to eat was observed in the first five hours of fasting, which is significantly lower in barley bread group than wheat bread group (P value<0.001). During the time, the increased desire to eat sense in both group was significantly decreased (P value; barley bread=0.04, wheat bread=0.001).

The rate of desire to eat adjusted based on energy intake before the Iftar displayed in the Figure 8. The result showed desire to eat before Iftar in barley bread group was significantly lower than wheat bread group (P value=0.016). In otherwise; during the time, desire to eat in barley bread group before the Iftar was significantly decreased (P value=0.07), but this decreased in wheat bread group was not statistically significant (P value=0.27).

The rate of desire to eat adjusted based on energy intake before the Sahur displayed in the Figure 9. The results indicated there is no significant differences in desire to eat before Sahur between barley bread and wheat bread group (P value=0.06). However, the rate of desire to eat before Sahur has a significant decrease over time in the barley bread group (P value=0.001), but this trend has no observed in wheat bread group (P value=0.09) (Figure 9).

Discussion

Our study showed that hunger and the desire to eat in the barley bread group was significantly lower than wheat bread group and sense of satiety in the barley bread group is higher in comparison to the wheat bread group during fasting.

Bread is the staple food of most Muslims and can be considered a component with significant effect on appetite and satiety during the fasting. Our results showed that rate of hunger and desire to eat adjusted based on energy intake during the fasting period and before the Iftar in barley bread group were significantly lower than wheat bread group. Also our results showed that during of the fasting time, sense of satiety in the barley bread group is higher in comparison to the wheat bread group. Johansson et al. [11] indicated that boiled barley kernels in evening meals decrease hunger sensation over 2 subsequent meals. Also, Vitaglione and colleagues evaluated the effect of bread enriched with barley beta-glucans vs. control bread on short-term appetite and on satiety-related hormones in healthy adults. The results of this study showed that bread enriched with barley beta-glucans, determined a higher reduction of hunger and also increase in fullness. Ghrelin was decreased and PYY was reduced, as well [20]. Therefore concentrations of circulating hormones of related to appetite such as peptide YY, glucagon-like peptide-1, ghrelin and peptin may be influenced by Barley β -glucan [15].

Another randomized control trial demonstrated that consumption of the cereal-based bread contributed to appetite control by reducing hunger and enhancing satiety compared with the control bread with the same energy, fat, and sugar [21]. All barely products compared with white wheat bread resulted in lower metabolic responses and higher satiety score [10]. In another study to investigate the effect of whole grain rye consumption on appetite and colonic fermentation after a subsequent meal, the results demonstrated that wholegrain rye, enhanced the production of satiety-inducing hormones such as PYY and GLP-1 [22]. Another study showed that rye bread breakfasts resulted in higher satiety ratings compared with sifted wheat bread [23]. One study showed whole grain wheat bread, resulted in increased

Characteristics	All (n=184)	Barley bread (n=102)	Wheat bread (n=82)	P value
Age, (years)				
Male	25 ± 6.5	24 ± 4.8	26.2 ± 7.8	0.15
Female	23.9 ± 6.5	24.1 ± 7.5	23.8 ± 4.9	0.8
Sex, n (%)				0.24
Male	70(38.1)	35(34.3)	35(42.7)	
Female	114(61.9)	67(65.7)	47(57.3)	
Married, n (%)	42(20.9)	22(21.6)	20(24.4)	0.61
Smoking, n (%)				0.2
Yes	2(1)	2(1.96)	0(0)	
No	182(99)	100(98.04)	82(100)	
Weight (kg)	65.7 ± 16.4	65.5 ± 18.1	66.1 ± 14.3	0.81
Height (cm)	166.1 ± 16.6	164.3 ± 20.8	168.3 ± 8.6	0.10
BMI (kg/m ²)	23.8 ± 8.4	24.4 ± 10.7	23.2 ± 4.1	0.36
WC (cm)	81.2 ± 11.9	80.6 ± 11.9	82.1 ± 11.9	0.43
SBP (mmHg)	114.6 ± 13.6	114 ± 14	115.5 ± 13.1	0.48
DBP (mmHg)	73.2 ± 10.2	72.2 ± 11	74.5 ± 9	0.13
Heart Rate	80.3 ± 13.3	80.3 ± 12.3	80.3 ± 14.7	0.74

Table 1: Characteristics of study participants.

Variables	Barley bread (n=102)	Wheat bread (n=82)	P value
Energy (kcal/day)	1860 ± 620	1854 ± 551	0.93
Protein (g/day)	83.6 ± 32	87.1 ± 36	0.51
Carbohydrates (g/day)	213 ± 64	221 ± 76	0.57
Fat (g/day)	74.8 ± 31.3	75.4 ± 30.2	0.98
Total dietary fiber (g/day)	11.5 ± 5.6	10.1 ± 4.2	0.14
Fluid (ml/day)	1102 ± 434	1143 ± 397	0.52
Caffeine (mg/day)	54.3 ± 11	58.2 ± 13	0.59

Table 2: Comparison of dietary intake between groups.

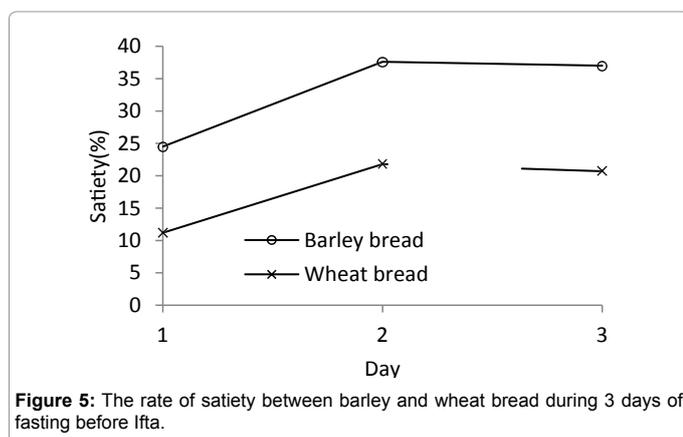


Figure 5: The rate of satiety between barley and wheat bread during 3 days of fasting before Ifta.

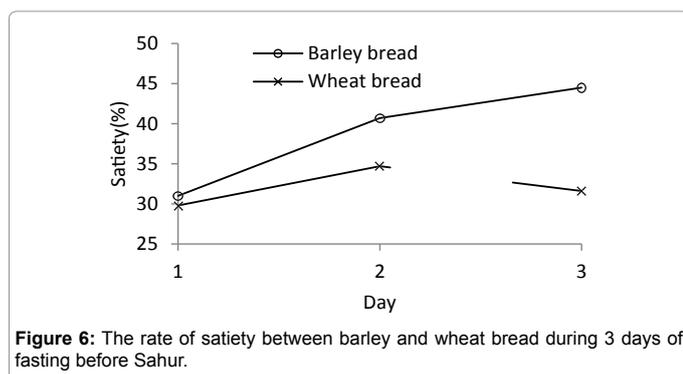


Figure 6: The rate of satiety between barley and wheat bread during 3 days of fasting before Sahur.

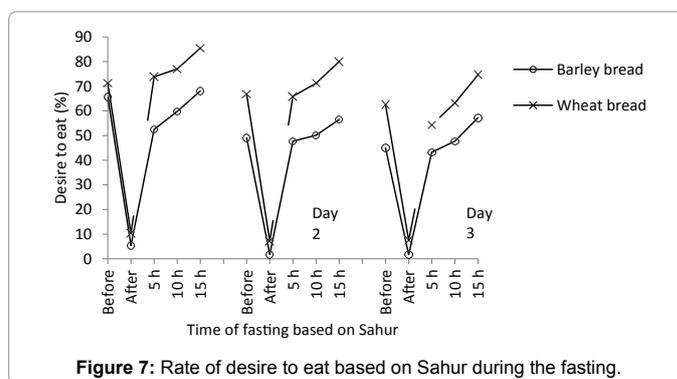


Figure 7: Rate of desire to eat based on Sahur during the fasting.

satiety and reduced hunger compared to refined wheat pasta [24]. Barley is contained of fermentable dietary fiber such as β -glucans and the fibers may modulate appetite through various mechanisms: it can be fermented in the colon by saccharolytic bacteria [25] also delay gastric emptying and slow the glycemic response increase and gastric distension caused by hydration would lead to early satiety [26]. Barley also promotes (control) the release of hormones relating to appetite such as peptide YY, glucagon-like peptide-1, ghrelin and Peptin and enhances the signaling of satiety and it can facilitate the regulation of glucose and amplify GLP-1 release that decrease hunger feeling and energy intake [20].

In the present study, we used a large sample population. To the best of our knowledge, this is the first study investigating the association between barley bread intake and hunger, satiety and desire to eat in

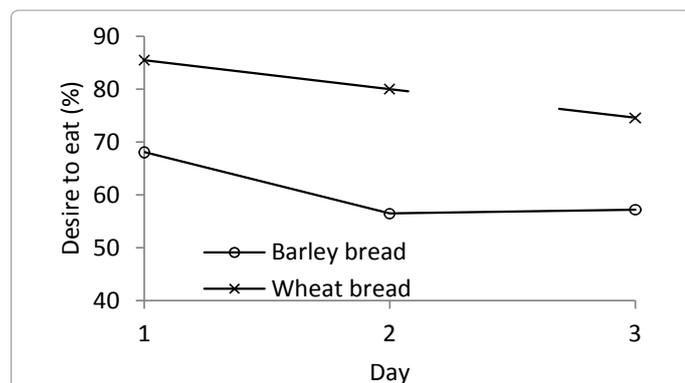


Figure 8: Rate of desire to eat adjusted based on energy intake before the Iftar.

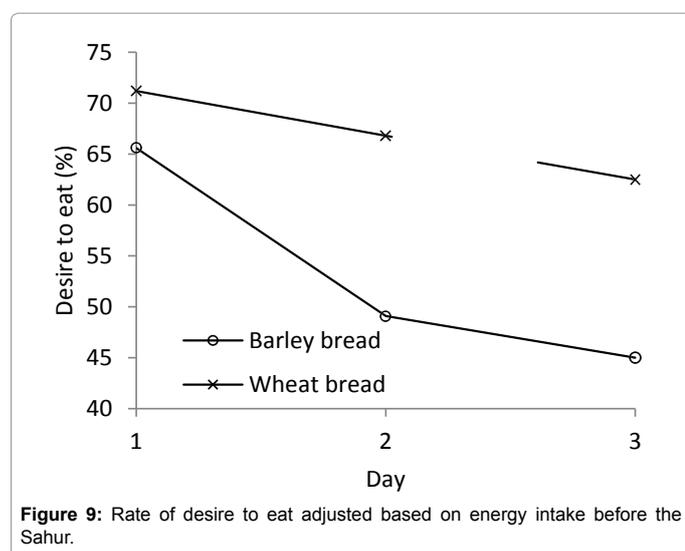


Figure 9: Rate of desire to eat adjusted based on energy intake before the Sahur.

three days of fasting. However, even in this short time we observed a significant effect of barley bread on appetite in fasting individuals. Longer period of enriched bread consumption might lead to additional benefits.

Appetite-related hormones such as ghrelin and PYY concentrations were not evaluated in our study. In order to reveal the mechanisms of barley in modulating appetite, satiety and energy intakes, it is necessary to evaluate these hormone concentrations in the future studies.

These results suggested barley bread can be consumed as an appetite decreasing food during the fasting.

Conclusion

Our study showed that barley bread was able to decrease appetite, desire to eat and increase the sense of satiety during the fasting compared with wheat bread group.

Conflict of Interest

All authors; declare no relevant competing financial interests to disclose.

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References

- Abolaban H, Al-Moujahed A (2017) Muslim patients in Ramadan: A review for primary care physicians. *Avicenna J Med* 7: 81-87.
- Vasan SK, Karol R, Mahendri N, Arulappan N, Jacob JJ, et al. (2012) A prospective assessment of dietary patterns in Muslim subjects with type 2 diabetes who undertake fasting during Ramadan. *Indian J Endocr Metab* 16: 552.
- Soleimani D, Nematy M, Hashemi M, Khayyat-zadeh SS (2016) Effects of Ramadan fasting on cardiovascular risk factors: A narrative review. *JFH* 4: 140-144.
- Nematy M, Alinezhad-Namaghi M, Rashed MM, Mozhdehifard M, Sajjadi SS, et al. (2012) Effects of Ramadan fasting on cardiovascular risk factors: a prospective observational study. *Nutr J* 11: 69.
- Sallie SA (1982) *The Book of Fasting*.
- Johnson S, Thomas S, Hall R (2005) Palatability and glucose, insulin and satiety responses of chickpea flour and extruded chickpea flour bread eaten as part of a breakfast. *Eur J Clin Nutr* 59: 169.
- Keogh J, Atkinson F, Eisenhauer B, Inamdara A, Brand-Miller J (2011) Food intake, postprandial glucose, insulin and subjective satiety responses to three different bread-based test meals. *Appetite* 57: 707-710.
- Hlebowicz J, Lindstedt S, Bjorgell O, Hoglund P, Almér LO, et al. (2008) The botanical integrity of wheat products influences the gastric distention and satiety in healthy subjects. *Nutr J* 7: 12.
- Najjar AM, Parsons PM, Duncan AM, Robinson LE, Yada RY, et al. (2018) The acute impact of ingestion of breads of varying composition on blood glucose, insulin and incretins following first and second meals. *Br J Nutr* 101: 391-398.
- Granfeldt Y, Liljeberg H, Drews A, Newman R, Björck I (1994) Glucose and insulin responses to barley products: influence of food structure and amylose-amylopectin ratio. *Am J Clin Nutr* 59: 1075-1082.
- Johansson EV, Nilsson AC, Ostman EM, Björck IM (2013) Effects of indigestible carbohydrates in barley on glucose metabolism, appetite and voluntary food intake over 16 h in healthy adults. *Nutr J* 12: 46.
- Ames N, Blewett H, Storsley J, Thandapilly SJ, Zahradka P, et al. (2015) A double-blind randomised controlled trial testing the effect of a barley product containing varying amounts and types of fibre on the postprandial glucose response of healthy volunteers. *Br J Nutr* 113: 1373-1383.
- Cheng A (2013) Canadian Diabetes Association 2013 clinical practice guidelines for the prevention and management of diabetes in Canada. *Can J Diabetes* 37: S1-S3.
- Thondre P, Shafat A, Clegg M (2013) Molecular weight of barley β -glucan influences energy expenditure, gastric emptying and glycaemic response in human subjects. *Br J Nutr* 110: 2173-2179.
- Aoe S, Ikenaga T, Noguchi H, Kohashi C, Kakumoto K, et al. (2014) Effect of cooked white rice with high β -glucan barley on appetite and energy intake in healthy Japanese subjects: a randomized controlled trial. *Plant Foods Hum Nutr* 69: 325-330.
- Powley TL, Phillips RJ (2004) Gastric satiation is volumetric, intestinal satiation is nutritive. *Physiol Behav* 82: 69-74.
- Chaudhri OB, Salem V, Murphy KG, Bloom SR (2008) Gastrointestinal satiety signals. *Annu Rev Physiol* 70: 239-255.
- Nilsson AC, Johansson-Boll EV, Björck IM (2015) Increased gut hormones and insulin sensitivity index following a 3-d intervention with a barley kernel-based product: a randomised cross-over study in healthy middle-aged subjects. *Br J Nutr* 114: 899-907.
- Flint A, Raben A, Blundell JE, Astrup A (2000) Reproducibility, power and validity of visual analogue scales in assessment of appetite sensations in single test meal studies. *Int J Obes Relat Metab Disord* 24: 38-48.
- Vitaglione P, Lumaga RB, Stanzione A, Scalfi L, Fogliano V (2009) β -Glucan-enriched bread reduces energy intake and modifies plasma ghrelin and peptide YY concentrations in the short term. *Appetite* 53: 338-344.
- Gonzalez-Anton C, Lopez-Millan B, Rico MC, Sanchez-Rodriguez E, Ruiz-Lopez MD, et al. (2015) An Enriched, Cereal-Based Bread Affects Appetite Ratings and Glycemic, Insulinemic, and Gastrointestinal Hormone Responses in Healthy Adults in a Randomized, Controlled Trial. *J Nutr* 145: 231-238.

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22. Ibrügger S, Vignsnæs LK, Blennow A, Skufflić D, Raben A, et al. (2014) Second meal effect on appetite and fermentation of wholegrain rye foods. *Appetite* 80: 248-256.
23. Isaksson H, Rakha A, Andersson R, Fredriksson H, Olsson J, et al. (2011) Rye kernel breakfast increases satiety in the afternoon-an effect of food structure. *Nutr J* 10: 31.
24. Kristensen M, Jensen MG, Riboldi G, Petronio M, Bugel S, et al. (2010) Wholegrain vs. refined wheat bread and pasta. Effect on postprandial glycemia, appetite, and subsequent ad libitum energy intake in young healthy adults. *Appetite* 54: 163-169.
25. Duncan SH, Louis P, Thomson JM, Flint HJ (2009) The role of pH in determining the species composition of the human colonic microbiota. *Environ Microbiol* 11: 2112-2122.
26. Aoe S, Ikenaga T, Noguchi H, Kohashi C, Kakumoto K, et al. (2014) Effect of cooked white rice with high beta-glucan barley on appetite and energy intake in healthy Japanese subjects: a randomized controlled trial. *Plant Foods Hum Nutr* 69: 325-330.