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Effect of Sorghum Based Resistant Starch Rich Product Supplementation on the Satiety Value.

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ABSTRACT

Subjective hunger and satiety may be influenced by a number of different factors, including physiological and psychological variables (Blundell, 1990). In order to assess subjective appetite sensations, visual analogue scale (VAS) scores were used viz. How hungry you are? How satisfied do you feel?. How full do you feel? and How much do you think you can eat?. The subjects were asked to score against 10 point scale. The scores for each sensation was tabulated and means were calculated and the differences among the total subjects as well as differences in males and females within the treatment was analyzed using one way ANOVA and presented

KEYWORDS :

INTRODUCTION

Resistant starch is a type of starch that isn't fully broken down and absorbed, but rather turned into short-chain fatty acids by intestinal bacteria.

This may lead to some unique health benefits. To get the most from resistant starch, choose whole, unprocessed sources of carbohydrate such as whole grains, fruits, vegetables, and beans/legumes. All starches are composed of two types of polysaccharides: amylose and amylopectin.

Amylopectin is highly branched, leaving more surface area available for digestion. It's broken down quickly, which means it produces a larger rise in blood sugar (glucose) and subsequently, a large rise in insulin.

Amylose is a straight chain, which limits the amount of surface area exposed for digestion. This predominates in RS. Foods high in amylose are digested more slowly. They're less likely to spike blood glucose or insulin.

Thus, resistant starch is so named because it *resists* digestion.

While most starches are broken down by enzymes in our small intestine into sugar, which is then absorbed into the blood, we can't fully absorb all kinds of starch.

Some starch — known as **resistant starch** (RS) — isn't fully absorbed in the small intestine. Instead, RS makes its way to the large intestine (colon), where intestinal bacteria ferment it.

RS can help us feel full. SCFAs can trigger the release of hormones that reduce the drive to eat (leptin, peptide YY, glucagon like peptide). After someone starts eating more RS, it may take up to one year for gut hormones to adapt.

RS slows the amount of nutrients released into the bloodstream, which keeps appetite stable.

One unique effect of RS that seems to be developing is the impact that these starches seem to have on satiety .With lifestyle modification–specifically reducing energy intake being a regular recommendation to prevent and treat various metabolic diseases and conditions (Poirier *et al.,* 2006; Jakicic*et al.*, 2001), this bioactive effect could be extremely beneficial from a public health perspective.

The means through which RS has been shown to induce satiety and lead to decrease energy intake (may not decrease volume or weight of food consumed) seems

likely to involve alterations in PYY and other neuro endocrine components (Zhou *et al.*, 2008).

Zhou *et al*. (2008) administered RS to mice over 32 days and observed that active forms of PYYand GLP-1 increased. The mice eating RS also gained less fat mass and had a lower ratio of body fat to body weight, while eating the same weight of food. Similarly, So *et al*. (2007) fed mice high and low RS diets and measured numerous body composition and metabolic parameters after the eight-week intervention.

Willis *et al*.(2009) observed satiety and feelings of fullness were evident longer following trials with RS and corn bran, compared with lower fibre bleached oat bran, b glucan, and polydextrose.

Anderson *et al*. (2010) indicate that foods containing 40–70% RS seem to reduce food intake during meals later in the day. In a study (Haub*et al.*, 2012), RS4 from potato starches elicited similar ratings of satiety when ingested with an energy dense beverage (dextrose solution) or ingested with water.

METHODOLOGY

A total of 14 healthy subjects (male -7, female -7) with age group ranging from 18-22 yrs were selected for the study. Single blinded cross over design was used, where the subjects were unaware about the food. Four types of most commonly used recipes were prepared using 50 g (18g of resistant starch) of either designer *rawa*or control *rawa*(5 g of Resistant starch) using standards procedures and supplemented for 21 days and after one week wash out period control food was supplemented for 21 days, during the study period the subjects were allowed to consume their regular foods.

Satiety Score

Two hours after the test meal and control meal, questionnaire has given to assess satiety of each subject. Ratings were made on 100-mm visual analogue scales (VAS) with words anchored at each end, expressing the most positive (i.e., good, pleasant) or the most negative ratings (i.e., bad, unpleasant). Immediately after the test and control meals the palatability, taste, after taste, texture and visual appeal of the two meals were recorded by the subjects using VAS scores. *(Raben et al., 1994)*

RESULTS AND DISCUSSION

Table 4.8 Mean satiety response of Resistant starch food *VS* control food of selected Subjects

Subjects		RS rich food				Control food		
	S1	S2	S3	S4	S1	S2	S3	S4
Over all	8.14	7.14	6.21	5.2	6.79	6.07	05.21	4.21
	(0.17)	(0.17)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)

Subjects		**RS rich food**				**Control food**		
Male	8.0	7.2	6.2	5.0	6.7	6.0	5.0	5.4
(n=7)	(0.2)	(0.18)	(0.18)	(0.21)	(0.18)	(0.21)	(0.21)	(0.2)
Female	8.28	7.28	6.57	6.0	6.8	6.14	5.42	5.71
(n=7)	(0.28)	(0.28)	(0.2)	(0.3)	(0.26)	(0.26)	(0.2)	(0.18)

Figures in parenthesis are SE, Significant (P< 0.05), S1- How hungry are you? S2- How satisfied do you feel? S3- How full do you feel? S4- How much do you think you can eat?

The mean scores ranged from 5 to 8.14 with RS food supplementation and that of control food ranged from 5.7 to 6.7 (intensity of hunger decreases with increasing score). There was no significant difference within the subjects and between the male and female subjects in all the means except S4 Resistant starch food (p=0.1) of satiety scores. The results of the paired t-test, performed to find out the differences in satiety scores before and after supplementation of RS rich diet and control diet are presented in Table 4.9. It was very clear from the data that there is significant effect of RS food on the satiety score of all the subjects (p<0.05). Sex wise also there was significant effect on three types of sensations indicating that consumption of RS food definitely delays the hunger sensation and can prolong next eating. Out of the four sensations for one sensation i.e *how much do you think you can eat* there was no significant difference between RS food and control food. Since three out of four sensations scored favorably

(higher satiety) when RS food is supplemented this food can be used as a dietary tool for controlling over eating.

Table 4.9 Effect of RS food *VS* normal food on satiety scores of healthy subjects

Details of pairing		Mean	SD	Sig. (2-tailed)
		Difference		
RS1-CS1	Over all	1.357	0.497	0.000*
	Female	1.429	0.535	0.000*
	Male	1.28571	0.48795	0.000*
RS2-CS2	Over all	1.071	0.267	0.000*
	Female	1.143	0.378	0.000*
	Male	1.28571	0.48795	0.000*
RS3-CS3	Over all	1.214	0.426	0.000*
	Female	1.143	0.378	0.000*
	Male	1.28571	0.48795	0.000*
RS4-CS4	Over all	-0.357	0.497	0.019*
	Female	-0.286	0.488	0.172
	Male	-0.42857	0.53452	0.078

S1- How hungry are you? S2- How satisfied do you feel?

S3- How full do you feel? S4- How much do you think you can eat? * Significant (P< 0.05) ** significant (P<0.01), F-female, M-male,

R.S.F- Resistant starch food, C.F- Control food. SD-Standard deviation.

With lifestyle modification–specifically reducing energy intake–being a regular recommendation to prevent and treat various metabolic diseases and conditions (Poirier*et al*., 2006; Jakicic *et al*., 2001), this bioactive effect could be extremely beneficial from a public health perspective. Anderson *et al*. (2010) indicated that foods containing40–70% RS seem to reduce food intake during meals later in the day. In a study (Haub*et al*., 2012), RS4 from potato starches elicited similar ratings of satiety when ingested with an energy dense beverage (dextrose solution) or ingested with water. In a meal that consisted of 50-g digestible potato starch resulted in greater feelings of satiety and fullness, compared with the meal that comprised resistant and slowly digestible starch (54% RS) within 1–1.5 hours, with the meal that consisted of raw potato starch, subjective scores returned to fasting concentrations, while the satiating power of thedigestible-starch meal lasted 2.5–3 hours postprandial (Raben *et al*., 1994). Consumption of 30 g/day of RS2 and RS3 in a 4-week study had little influence on appetite and food intake De Roos *et al*. (1995). In the present study higher satiety value

can be ascribed to the dietary fibre content of the sorghum grain. The dietary fibre content of sorghum flour was reported to contain up to 9.0% (Nayman *et* al., 1984).

It has previously been stated that changes in satiety after a carbohydrate load may be mediated through an effect of plasma glucose on hepatic glycogen concentration on specific glucosensitive cells in the brain (Forebs *et al*., 1992) and studies have demonstrated a satiating effect of carbohydrate (Van Amelsvoort *et al.,*

1990).

CONCLUSION

Significant differences (P<0.05) were observed in the satiety scores of RS food and control food, which ranged from 5 to 8.14 and 5.7 to 6.7 (intensity of hunger decreases with increasing score) respectively. There was no significant difference within the subjects and between the male and female subjects in all the mean scores except S4 (How much do you think you can eat?) of RS food (p=0.1).

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