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Chapter 12

The Effect of Myco-protein on Hunger, Satiety and Subsequent Food Consumption

W.H. TURNBULL, D. BESSEY, J. WALTON and A.R. LEEDS
Department of Nutrition and Dietetics, King's College London, University of London, Campden Hill Road, London W8 7AH, UK

Introduction

Myco-protein is a food produced by continuous fermentation of *Fusarium graminearum* (Schwabe) on a carbohydrate substrate. The development of myco-protein began in the mid 1960s (Owen *et al.*[5], Edelman *et al.*[2], Udall *et al.*[8]) and after 20 years of extensive research UK authorities approved it for sale to the general public in 1985. The raw product and a large number of prepared dishes are now available through major food retailers. The product is sold under the trade name of Quorn (reg. trade mark of Marlow Foods, UK).

Previous studies on myco-protein (Turnbull *et al.*[7], Udall *et al.*[8]) to investigate its effects on blood variables in man demonstrated that subjects felt quite full after consuming a meal containing myco-protein. It was postulated that the effects seen on appetite may have been due to the fact that myco-protein contains a considerable dietary fibre component. For this reason it was decided to design the described study to investigate the effects of myco-protein on appetite and energy consumption in man.

The terms hunger, appetite, and satiety are commonly used, although they are not always clearly defined. Appetite might be regarded as a process which comes into operation once eating has begun and guides the selection of foods (Blundell *et al.*[1]). Hunger is a motivational construct with the logical status of an intervening variable (McQuorquodale *et al.*[4], Udall *et al.*[8]). The layman recognizes hunger in terms of the conscious sensations linked to a desire to obtain and eat food. Satiety can be defined as the "state of inhibition over further eating", whereas satiation is the process which brings eating to a close (Blundell *et al.*[1]).

Methods

Materials

The nutrient content of myco-protein is shown in Table 1. The myco-protein meal and the control meal (containing chicken) were nutrient balanced (Table 2) except for the dietary fibre found in myco-protein (6.7 g/meal). The fibre content of myco-protein (25% of dry matter) is attributable to its cell wall components, approximately 1/3 chitin (poly n-acetyl glucosamine) and 2/3 insoluble beta glucan.

Table 1. Nutrient content of myco-protein per 100 g

Protein, g		11.8
Dietary fibre, g		4.8
Total fat, g		3.5
Saturated fat, g		0.6
Monounsaturated fat, g		0.7
Polyunsaturated fat, g		1.3
Other lipids, g		0.9
Carbohydrate, g		2.0
Energy,	kcal	86
	MJ	0.36

Table 2. Nutrient content of meals

		Chicken	Myco-protein
Energy,	kcal	579	561
	MJ	2.43	2.36
Protein, g		44.5	44.2
Fat, g		10.9	10.2
Carbohydrate, g		80.8	76.8
Dietary fibre, g		10.1	16.8

Subjects

Thirteen female subjects (BMI < 25.0 kg/m^2) were found suitable to participate in the study after screening using an eating habits questionnaire in order to eliminate subjects who were restrained eaters. Subjects were not aware of the nature of the study.

Study procedure

Subjects were randomly allocated to attend the metabolic unit, after fasting from midnight, to consume a set meal. 100 mm visual analogue scales (VAS) were completed before the meal asking questions about desire to eat, hunger, fullness and prospective consumption. The meal was then presented and subjects were asked to consume everything. Immediately after the meal subjects were given another VAS which in addition to the pre-meal questions requested information on the pleasantness of the meal. Further VAS were give at 1, 2 and 3 h post meal. Subjects had no verbal or visual contact with each other during the meal. Weighed dietary records were kept on the day before the study, on the day of the study and the following day. This procedure was repeated the following week until all subjects had consumed both meals.

Results

There was a decrease in desire to eat after eating myco-protein compared with chicken (Fig. 1). There was a decrease in hunger after eating myco-protein compared with chicken (Fig. 2). Fullness increased after eating myco-protein compared with chicken (Fig. 3). Prospective consumption decreased after the myco-protein meal compared with chicken (Fig. 4). There was a decrease in energy intake of 263 kcal/d after consuming the myco-protein meal compared with the chicken (Fig. 5).

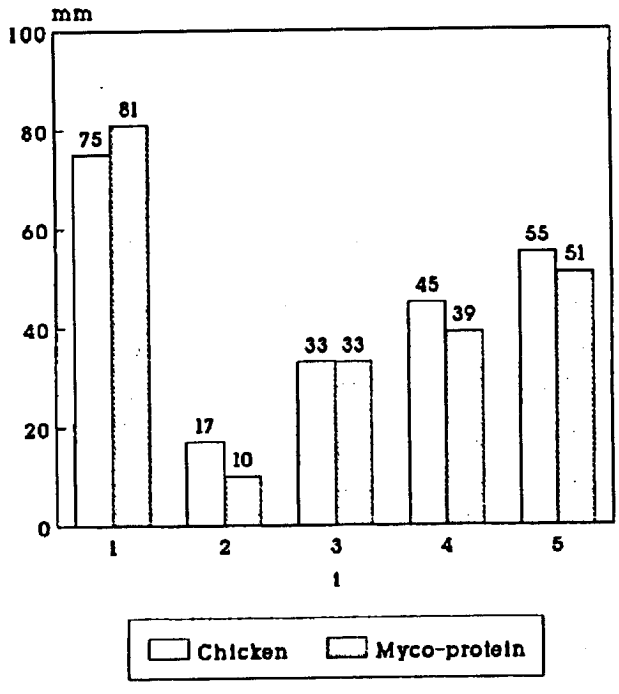

Fig. 1. Desire to eat
1 = immediately pre-meal; 2 = immediately post-meal; 3–5 = 1, 2 & 3 h post-meal.

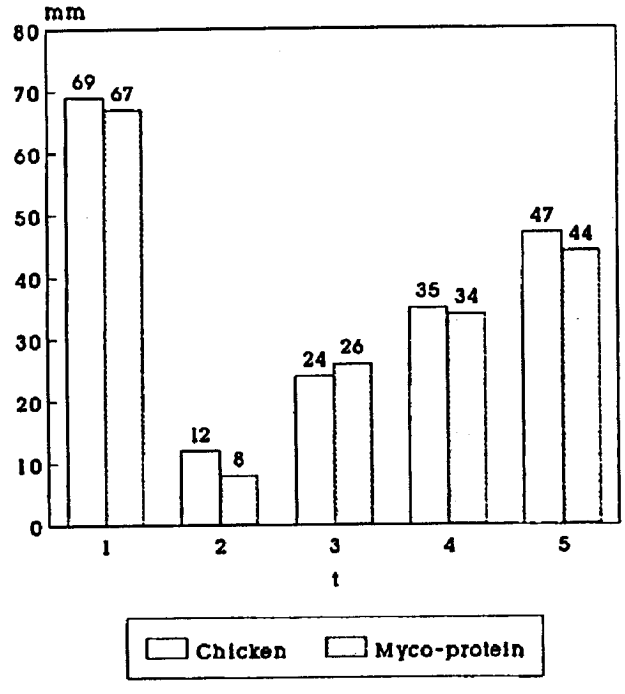

Fig. 2. Hunger
1 = immediately pre-meal; 2 = immediately post-meal; 3–5 = 1, 2 & 3 h post-meal.

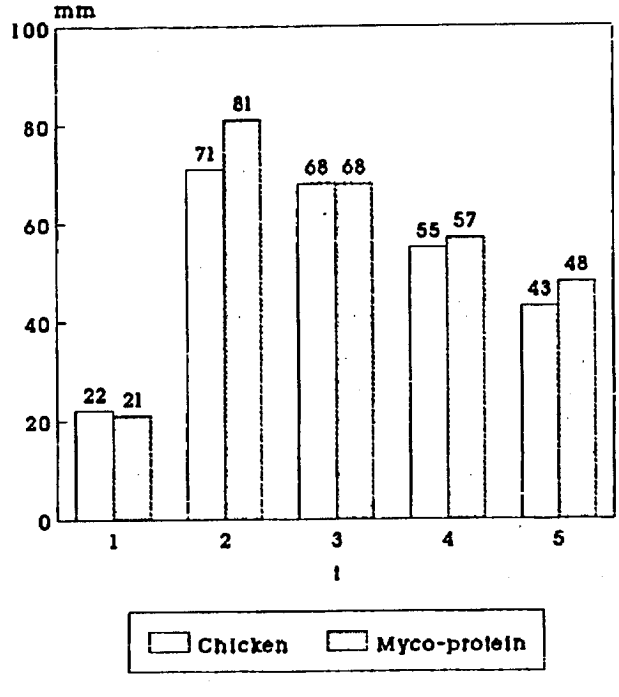

Fig. 3. Fullness
1 = immediately pre-meal; 2 = immediately post-meal; 3–5 = 1, 2 & 3 h post-meal.

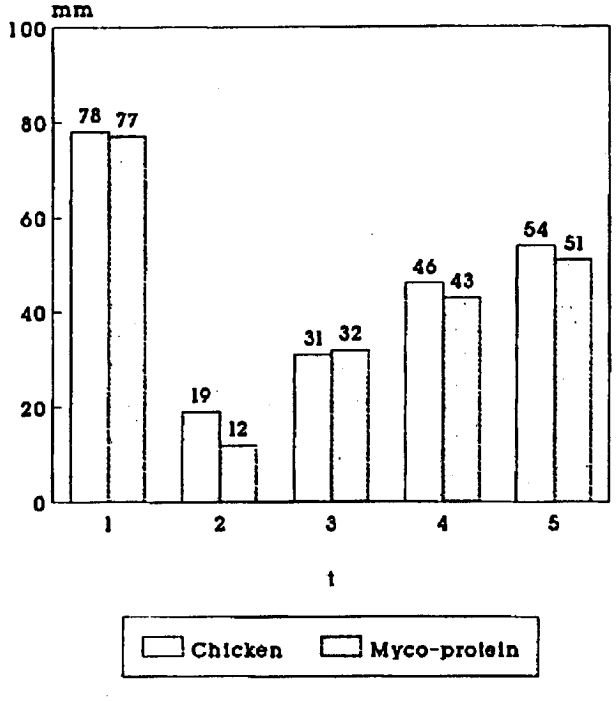

Fig. 4. Prospective consumption
1 = immediately pre-meal; 2 = immediately post-meal; 3–5 = 1, 2 & 3 h post-meal.

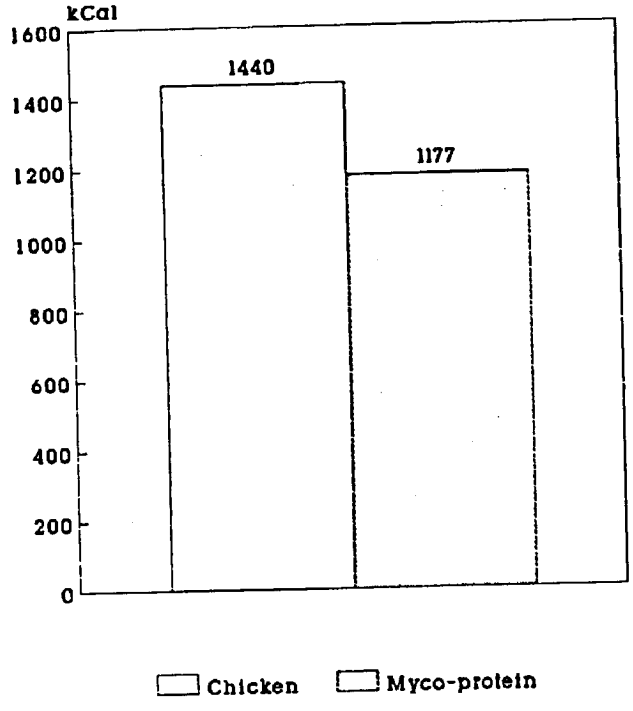

Fig. 5. Energy intake for rest of test day.

Discussion

It seems from this first study investigating the effect of myco-protein on appetite variables that food intake can be reduced without the perception of feeling hungry. Because both meals were macro-nutrient balanced the effects may be due to the difference in the dietary fibre composition of the meals. Other studies have shown similar effects of dietary fibre (Levine *et al.*[3]).

Much of the effect on appetite variables is seen 2 to 3 h after the meal or even later when energy intake was considerably reduced. The larger physical volume of the myco-protein meal could have caused greater gastric distension, which could initiate satiety at an earlier stage than the chicken meal, thus reducing the desire to eat and prospective consumption. Myco-protein may have delayed gastric emptying (possibly by increasing stomach content viscosity) and may also have decelerated intestinal transit thus extending the state of satiety.

Conclusion

It seems that there is an effect of myco-protein on energy intake and appetite variables and it may be of some use in the treatment of obesity although we can not be over-confident at this early stage in this research. Further studies are underway using more complex methods of study design.

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