Table 5

Means of intake of energy, macronutrients, and fatty acids in relation to specific subgroups of breast cancer

	Energy (Joules/day)	Total fat (g/day)	Energy-adjusted fat (g/day)	SFA (g/day)	Energy-adjusted SFA (g/day)	MUFA (g/day)	Energy-adjusted MUFA (g/day)	PUFA (g/day)	Energy-adjusted PUFA (g/day)
Cyclin D_1[a]									
P value	0.02*	0.007**	0.16	0.002*	0.04*	0.006**	0.13	0.32	0.31
Low	1957	82	81	35	34	29	28	13	13
High	1652	63	76	25	30	22	26	11	13
Cyclin E[b]									
P value	0.26	0.07	0.09	0.09	0.18	0.08	0.12	0.07	0.15
Low	1937	80	81	34	34	28	28	13	13
High	2123	97	88	42	38	34	31	15	14
Ki67[c]									
P value	0.029*	0.004**	0.048*	0.019*	0.315	0.004**	0.058	0.003**	0.053
Low	1984	84	82	35	35	29	29	13	13
High	1850	75	79	32	34	26	28	12	12

All analyses are adjusted for age, diet assistant, period, method version and changed dietary habits. Energy adjustment is applied where stated. [a]Cyclin D_1 overexpression with nucleus fraction ≥50%. [b]Cyclin E overexpression with nucleus fraction ≥50%. [c]High proliferation index with nuclear fraction ≥10. *$P < 0.05$; **$P < 0.01$. MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids.

In this report we demonstrate an association between highly proliferative tumours and low energy intake, as well as low intakes of fat and PUFA. Several other human studies have reported that high energy intake is related to increased risk for breast cancer [31,32], but it is still unclear whether fat has a specific impact on breast cancer risk [7,9]. To our knowledge, no studies have reported on any association between diet and proliferation in breast cancer.

Furthermore, we found an association between low energy intake, particularly low fat intake, and overexpression of cyclin D_1. Cyclin E, however, was positively associated with fat intake, but this association did not remain significant in the dichotomized analyses. The opposite behaviours for cyclin D_1 and cyclin E are in accordance with earlier observations showing that cyclin E overexpressing tumours are low in cyclin D_1 and *vice versa* [33]. Experimental animal studies support our findings of a connection between dietary intake and cell cycle regulators because energy restriction has been demonstrated to reduce mammary tumour cell proliferation via G_1 cell cycle arrest, possibly through increased expression of p27 and reduced expression of cyclin D_1 [18,34]. This may appear to be in conflict with our results, in which low energy intake was associated with cyclin D_1 overexpression, and p27 did not exhibit any connection to energy intake. However, animal models using chemically induced breast tumours cannot readily be translated into a far more complex tumour genesis in humans, which presumably are influenced by a multitude of environmental factors.

Subgroups defined by ER were not linked to dietary behaviour or body composition. Some studies indicate that high fat diets are associated with increased risk for ER-positive tumours [35-37], whereas Verreault and coworkers [38] found no association between dietary fat and ER status. A few studies suggest that different types of PUFA may have opposing influences on breast cancer risk [39,40]. Studies concerning body constitution report an increased risk for ER-positive tumours in obese postmenopausal women who are supplied with oestrogens via conversion of androstendione to oesterone in fat tissues, which is in contrast to premenopausal women, whose primarily oestrogen source is the ovaries [41]. However, the present analyses include both premenopausal and postmenopausal women because there are only a limited number of cases in each subgroup, making further stratification into premenopausal and postmenopausal women unsuitable. This might explain the different results. Furthermore, analyses in the present study did not include healthy control individuals, which might also have contributed to the different results. However, in order to map potential differences in anthropometric risk factors in premenopausal and postmenopausal breast cancer, we performed separate analyses, which confirmed our initial results in the entire cohort. In addition, premenopausal breast tumours were characterized by high proliferation and low expression of p27 in tall women. The suppressor gene product p27 was not associated with any examined variable in the entire cohort. Few comparable human studies have addressed the relationship between p27 and dietary habits or body constitution; Daling and coworkers [42] examined the relation-