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Long-term effects of an antenatal lifestyle intervention alongside routine care on maternal postpartum health behaviour and child development

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Abstract

Poor maternal health behaviours and overweight and obesity from preconception to the postpartum period as well as high weight gain during pregnancy and in the inter-pregnancy period are known to exert detrimental effects on maternal health and offspring development and increase the risk for overweight and obesity for mother and child. In the light of the increasing prevalence of overweight and obesity in women of childbearing age as well as in children, supporting maternal health behaviours during pregnancy and in the postpartum period to optimise body weight is of high importance. Several lifestyle intervention trials have aimed at improving maternal health behaviours and gestational weight gain during pregnancy, but the long-term effects of such interventions on the women and their offspring could not yet be conclusively clarified.

This thesis aimed at elucidating the effect of a large-scale antenatal lifestyle intervention on improving maternal postpartum health behaviour and child anthropometrics and neurodevelopment at 2 and 3 years of age.

The cluster-randomised GeliS trial ("Gesund leben in der Schwangerschaft"/healthy living in pregnancy) was performed alongside the German routine antenatal care system in women with normal weight, overweight and obesity. The aim of the trial was to limit the proportion of women with excessive gestational weight gain and to improve maternal and child health through an antenatal lifestyle intervention. Of the originally recruited 2286 participants, 1899 women provided data on postpartum dietary, physical activity and smoking behaviours which were collected using questionnaires at 6–8 weeks (T1pp) and 1 year (T2pp) postpartum. 1644 participants provided information on child development up to 3 years of age. Information on child anthropometrics was collected from routine health examinations and child neurodevelopment was assessed using the Ages and Stages Questionnaire (ASQ).

The GeliS lifestyle intervention exerted slight positive effects on maternal postpartum health behaviour. Women from the intervention group (IG) had a slightly higher diet quality (T1pp: $p = 0.093$; T2pp: $p = 0.043$), consumed less fast food (T1pp: $p = 0.016$; T2pp: $p < 0.001$) and soft drinks (T1pp: $p < 0.001$), had a higher intake of vegetables (T2pp: $p = 0.015$) and were more likely to use healthy oils for food preparation. However, there was no evidence for a difference in total energy and macronutrient intake and no major difference in physical activity behaviour between the groups in the first year postpartum. The rate of smokers was significantly lower in women from the IG than the control group (CG) throughout the postpartum period.

There was no evidence for an effect of the GeliS lifestyle intervention on child development. The mean weight, height, head circumference and BMI as well as the respective percentiles and z-scores were comparable between children from the IG and CG at 2 and 3 years of age. Similarly, the ASQ scores were comparable between the groups with the exception of slightly

lower scores in Problem-solving in the IG (p <0.001). Children from the IG were slightly more likely to have a potential delay in development in Problem-solving (p <0.001) and slightly less likely to have a potential delay in the Fine motor domain (p = 0.002).

In conclusion, the GeliS lifestyle intervention had lasting effects on maternal dietary and smoking behaviours and thereby successfully improved maternal health behaviour in the first year postpartum. However, no influence of the intervention on child development was observed. Future trials focusing on improving maternal short- and long-term health behaviours and child development should consider an intervention initiation in the preconception period, delivery by lifestyle experts and/or telehealth modalities, adequate incentives for participation for the control group and address the health literacy of the participants.

Zusammenfassung

Nachteiliges mütterliches Gesundheitsverhalten sowie Übergewicht und Adipositas von der Zeit vor der Konzeption bis zur postpartalen Zeit sowie eine hohe Gewichtszunahme während der Schwangerschaft und in der Zeit zwischen den Schwangerschaften wirken sich bekanntermaßen nachteilig auf die Gesundheit der Mutter und die Entwicklung des Nachwuchses aus und erhöhen das Risiko für Übergewicht und Adipositas bei Mutter und Kind. Angesichts der zunehmenden Prävalenz von Übergewicht und Adipositas bei Frauen im gebärfähigen Alter und bei Kindern ist die Unterstützung des Gesundheitsverhaltens von Müttern während der Schwangerschaft und in der Zeit nach der Geburt zur Optimierung des Körpergewichts von großer Bedeutung. Mehrere Lebensstilinterventionsstudien zielten darauf ab, das Gesundheitsverhalten der Mütter und die Gewichtszunahme während der Schwangerschaft zu verbessern, doch die langfristigen Auswirkungen solcher Interventionen auf die Frauen und ihre Kinder konnten noch nicht abschließend geklärt werden.

Ziel dieser Arbeit war es, die Auswirkungen einer groß angelegten pränatalen Lebensstilintervention auf das mütterliche Gesundheitsverhalten nach der Geburt sowie auf die Anthropometrie und die neurologische Entwicklung der Kinder im Alter von 2 und 3 Jahren zu untersuchen.

Die cluster-randomisierte GeliS-Studie ("Gesund leben in der Schwangerschaft"/healthy living in pregnancy) wurde parallel zur deutschen routinemäßigen Schwangerenbetreuung bei Frauen mit Normalgewicht, Übergewicht und Adipositas durchgeführt. Ziel der Studie war es, den Anteil der Frauen mit übermäßiger Gewichtszunahme während der Schwangerschaft einzuschränken und die Gesundheit von Mutter und Kind durch eine pränatale Lebensstilintervention zu verbessern. Von den ursprünglich rekrutierten 2286 Teilnehmerinnen lieferten 1899 Frauen Daten zum postpartalen Ernährungs-, Bewegungs- und Rauchverhalten, die mithilfe von Fragebögen 6-8 Wochen (T1pp) und 1 Jahr (T2pp) nach der Geburt erhoben wurden. 1644 Teilnehmer machten Angaben zur Entwicklung des Kindes bis zum Alter von 3 Jahren. Informationen über die Anthropometrie der Kinder wurden bei routinemäßigen Gesundheitsuntersuchungen erhoben, und die neurologische Entwicklung der Kinder wurde mit dem Ages and Stages Questionnaire (ASQ) beurteilt.

Die GeliS-Lebensstilintervention wirkte sich leicht positiv auf das Gesundheitsverhalten der Mütter nach der Geburt aus. Frauen aus der Interventionsgruppe (IG) hatten eine etwas höhere Ernährungsqualität (T1pp: p = 0,093; T2pp: p = 0,043), konsumierten weniger Fast Food (T1pp: p = 0,016; T2pp: p <0,001) und Softdrinks (T1pp: p <0,001), hatten einen höheren Verzehr von Gemüse (T2pp: p = 0,015) und verwendeten eher gesunde Öle für die Nahrungszubereitung. Es gab jedoch keinen Hinweis auf einen Unterschied in der Gesamtenergie- und Makronährstoffaufnahme und keinen wesentlichen Unterschied im Bewegungsverhalten zwischen den Gruppen im ersten Jahr nach der Geburt. Der Anteil der

Raucherinnen war bei den Frauen aus der IG während der gesamten Zeit nach der Geburt signifikant niedriger als in der Kontrollgruppe (CG).

Es gab keine Hinweise auf eine Auswirkung der GeliS-Lebensstilintervention auf die Entwicklung der Kinder. Das mittlere Gewicht, die Größe, der Kopfumfang und der BMI sowie die jeweiligen Perzentile und z-Scores waren zwischen den Kindern der IG und der CG im Alter von 2 und 3 Jahren vergleichbar. Auch die ASQ-Werte waren zwischen den Gruppen vergleichbar, mit Ausnahme der etwas niedrigeren Werte im Bereich Problemlösekompetenz in der IG (p <0,001). Bei Kindern aus der IG war die Wahrscheinlichkeit einer potenziellen Entwicklungsverzögerung im Bereich Problemlösekompetenz etwas höher (p <0,001) und die Wahrscheinlichkeit einer potenziellen Verzögerung im Bereich Feinmotorik etwas geringer (p = 0,002).

Zusammenfassend lässt sich sagen, dass die GeliS-Lebensstilintervention nachhaltige Auswirkungen auf das Ernährungs- und Rauchverhalten der Mütter hatte und somit das Gesundheitsverhalten der Mütter im ersten Jahr nach der Geburt erfolgreich verbesserte. Es wurde jedoch kein Einfluss der Intervention auf die Entwicklung der Kinder festgestellt. Künftige Studien, die sich auf die Verbesserung des kurz- und langfristigen Gesundheitsverhaltens von Müttern und der kindlichen Entwicklung konzentrieren, sollten einen Interventionsbeginn in der Zeit vor der Konzeption, die Durchführung durch Lebensstilexperten und/oder telemedizinische Modalitäten, angemessene Anreize für die Teilnahme der Kontrollgruppe und die Gesundheitskompetenz der Teilnehmerinnen berücksichtigen.

List of Abbreviations

ASQ	Ages and stages questionnaire (ASQ-3^{TM})
BMI	Body mass index
CG	Control group
CI	Confidence interval
DEGS	German health examination survey for adults
DGE	German nutrition society
DHA	Docosahexaenoic acid
FFQ	Food frequency questionnaire
GDM	Gestational diabetes mellitus
GEEs	Generalised estimating equations
GeliS	“Gesund Leben in der Schwangerschaft“ / healthy living in pregnancy
GWG	Gestational weight gain
HbA1c	Glycosylated haemoglobin
HEI	Healthy eating index
IG	Intervention group
IOM	Institute of Medicine (now: National Academy of Medicine)
L	Lifestyle counselling session
LGA	Large for gestational age
MET	Metabolic equivalent of task
OGTT	Oral glucose tolerance test
PA	Physical activity
PPAQ	Pregnancy physical activity questionnaire
Q	Questionnaire
RCTs	Randomised controlled trials
SGA	Small for gestational age
T1pp	6–8 weeks postpartum
T2pp	1 year postpartum
TALIA	Total physical activity of light intensity and above
TEL	Telephone interview
U	Child health examination
V0	Screening visit
Wk gest	Weeks of gestation
Wk post	Weeks postpartum

1 Introduction

1.1 The obesity pandemic and its connection to pregnancy

Worldwide, the prevalence of overweight and obesity is on the rise. Between 1975 and 2016, the prevalence of obesity has nearly tripled, with 39% of the world's adult population affected with overweight and 13% with obesity in 2016 [1]. Women in childbearing age are similarly affected. In Germany, 30% of women aged 18–29 years and 38% of women aged 30–39 years are overweight or obese [2] and almost 40% of pregnant women were diagnosed with overweight or obesity at the first routine antenatal care examination in 2017 [3]. Similarly, alarming numbers have been reported for children. According to the World Health Organization, 39 million children younger than 5 years had overweight or obesity in 2020 [1]. In the US, data from 1999–2018 showed an increase in the prevalence of overweight from 14.1% to 16.1% and in the prevalence of obesity from 14.7% to 19.2% with a slightly higher prevalence of obesity in boys than in girls [4]. The KiGGS Wave 2 study conducted from 2014–2017 revealed similar high numbers for Germany with 15.4% of children and adolescents between 3–17 years of age having overweight and 5.9% facing obesity [5]. However, no gender differences were observed in Germany [5].

In the light of these high numbers of adults and children suffering from overweight and obesity, it is of special interest that pregnancy has been identified as a time during which the maternal lifestyle affects both maternal and child obesity risk. In women, lifestyle and the related pre-pregnancy weight status are associated with an increased risk of excessive weight gain during pregnancy [6–8] which in turn increases the risk of postpartum weight retention [9] and contributes to the risk of overweight and obesity [10]. At the same time, maternal obesity and excessive weight gain are features of maternal over-nutrition during pregnancy [11] which may be connected to a developmental programming of the foetus and thereby to an increased risk for overweight and obesity and adverse health outcomes later in life [12–15]. This intergenerational cycle in which maternal lifestyle and obesity increases the offspring obesity risk [16] marks pregnancy as a time of high interest when it comes to obesity prevention. In the following, the lifestyle factors contributing to the risk of overweight and obesity in mothers and their children as well as their relations to maternal health and on child development will be explained in more detail and the effects of antenatal interventions on women and their offspring will be summarised.

1.2 Maternal lifestyle and health during pregnancy and postpartum

1.2.1 The Western lifestyle

In the US as well as in European countries, daily life is often characterised by an unhealthy Western lifestyle regarding diet and physical inactivity. The Western dietary pattern typically features a higher intake of processed meat, red meat, high-fat dairy products, butter, eggs and refined grains [17]. 40–75 % of the energy intake of the Western diet comes from glucose, mostly derived from starchy foods and sugars, and the ratio of omega-6 to omega-3 fatty acids is unfavourable [18]. With regard to sedentary behaviour, the prevalence has been increasing from 49.3% in 2002 to 54.3% in 2017 in the European Union [19]. Next to the high intake of calorie-dense refined foods and the lack of physical activity (PA), further routines such as eating too quickly and lack of sleep are also part of the modern Western lifestyle, and together these factors contribute to weight gain and therefore to an increased risk of overweight and obesity [18,20]. And indeed, the prevalence of overweight and obesity has increased worldwide with the spread of the Western lifestyle [1,18].

1.2.2 Implications of weight status and lifestyle during pregnancy

Overweight and obesity are known to have a detrimental effects on health and are associated with an increased risk for e.g. cardiovascular disease, type 2 diabetes mellitus and certain types of cancer [21]. In women in childbearing age, overweight and obesity are related to additional short and long-term risks during and after pregnancy. Research has revealed associations with complications such as preeclampsia [22], gestational hypertension [22], gestational diabetes mellitus (GDM) [22], high gestational weight gain (GWG) [6], preterm birth [22], caesarean section [23], large for gestational age (LGA) offspring [22] and a lower rate of breastfeeding [24]. Furthermore, excessive GWG itself is associated with an increased risk of pregnancy complications [22], caesarean delivery [25], long-term postpartum weight retention [9] as well as maternal overweight and obesity [10].

Apart from pre-pregnancy body mass index (BMI) and GWG, lifestyle during pregnancy also affects maternal and obstetric outcomes. For instance, prenatal exercise seems to lower the odds of GDM [26], gestational hypertension [26], pre-eclampsia [26], and excessive GWG [7] and is associated with a reduced risk of emergency caesarean section [7]. Conversely, longer sedentary time is weakly associated with increased blood loss during birth/postpartum [7], non-favourable self-rated health [7] and may result in shorter gestation and poorer foetal growth [27]. In terms of diet, higher intake of fruits, vegetables, legumes and fish seem to be associated with positive pregnancy outcomes [28], whereas a Western type diet seems to increase the odds for induced preterm birth [29], and especially intakes of red and processed meat products prior to pregnancy are connected with a higher risk of GDM [30].

Therefore, it is of particular interest that pregnancy has been shown to not only be a time of increased risk of health consequences, but also a window of opportunity to improve the maternal lifestyle [31]. Expecting a child seems to motivate women to adopt a healthy lifestyle, even if healthy lifestyle habits were not a main concern before [32]. The increased motivation may be due to an increased awareness of the effect their own health could have on the unborn offspring [32]. This willingness to change habits during pregnancy offers a unique chance to improve maternal lifestyle and to prevent excessive GWG which in turn may improve obstetric outcomes and maternal and child health.

1.2.3 Lifestyle recommendations during pregnancy

For an optimal support of maternal and foetal health, women are advised to adhere to a healthy lifestyle during pregnancy. The German recommendations on diet and lifestyle during pregnancy are described in the recommendations of the "Healthy Start – Young Family Network" [33]. An overview of these recommendations is given in Table 1. Pregnant women are recommended to focus on diet quality to cover their requirement of vitamins, minerals and trace elements, they should eat a varied and balanced diet as recommended by the German Nutrition Society (DGE) for adults [34], drink only moderate amounts of caffeinated beverages and avoid alcohol and smoking (see Table 1). In terms of exercise, women are encouraged to follow the general exercise recommendations for adults (moderate PA for at least 30 minutes at least 5 days a week) and restrict or regularly interrupt sedentary activities (see Table 1).

Table 1 Recommendations from the "Healthy Start – Young Family Network" on diet and lifestyle during pregnancy.

Energy and nutritional requirements	• Focus on quality of diet due to higher increase in the requirement of vitamins and minerals/trace elements than in total energy requirement • Only slight increase in energy intake (up to 10%) and not until the last few months of pregnancy

Nutrition	• Varied and balanced diet before and during pregnancy based on general recommendations for adults
	  ○ Larger amounts of calorie-free beverages and plant-based foods
	  ○ Moderate amounts of animal-based foods (e.g. milk and dairy products, low-fat meat and meat products, oily sea fish and eggs)
	  ○ Small amounts of sweets, sugar-containing beverages, snacks, fats with high proportion of saturated fatty acids and oils (plant oils as preferred source of fat)
	• Only moderate amounts of caffeinated beverages
	• Avoidance of alcohol

Supplements	• 400 µg/day of folic acid (from 4 weeks before conception until the end of the 1st trimester) ➔ Higher doses if folic acid supplementation is started less than 4 weeks before conception) • 100–150 µg/day of iodine • Iron supplementation only in case of a medically diagnosed deficiency

	• DHA supplements recommended if oily sea fish is not consumed regularly
Prevention of food-borne illnesses	• Avoidance of raw, animal-based foods • Follow recommendations to avoid listeriosis and toxoplasmosis regarding choice, storage and preparation of foods • Consumption of eggs only if yolk and egg white are heated until firm
Exercise	• Follow general exercise recommendations for adults and be physically active in everyday life • Restriction or regular interruption of sedentary activities • Moderate PA for at least 30 minutes at least 5 days a week (talk test) • Higher intensities possible in case of previous engagement in sports
Smoking	• Avoidance of smoking • No abidance in rooms where people are smoking or have smoked

Abbreviations: DHA: Docosahexaenoic acid; PA: Physical activity.
Data source: summarised from "Diet and Lifestyle Before and During Pregnancy – Practical Recommendations of the Germany-wide Healthy Start – Young Family Network" [33].

Next to these lifestyle recommendations, the extent of weight gain during pregnancy is of importance. According to the recommendations of the American Institute of Medicine (IOM; now called National Academy of Medicine), the amount of weight women should gain during pregnancy depends on their pre-pregnancy BMI [35]. The recommendations for GWG are summarised in Table 2. Women with normal weight before pregnancy should gain between 11.5–16.0 kg, whereas women with overweight should limit their weight gain to 7.0–11.5 kg and women with obesity should gain no more than 9 kg [35].

Table 2 Recommendations for total gestational weight gain according to the Institute of Medicine guidelines from 2009.

Pre-pregnancy BMI	**Recommended total gestational weight gain [kg]**
Underweight (<18.5 kg/m^2)	12.5–18.0
Normal weight (18.5–24.9 kg/m^2)	11.5–16.0
Overweight (25.0–29.9 kg/m^2)	7.0–11.5
Obese (≥30.0 kg/m^2)	5.0–9.0

Abbreviations: BMI: Body mass index.
Data source: adapted from the Institute of Medicine guidelines [35].

Many preconceptual and pregnant women do not succeed in meeting lifestyle recommendations [36–38]. Worldwide, around 9.8% of pregnant women are estimated to consume alcohol during pregnancy [39]. In Germany, the KiGGS survey revealed that around 14% of pregnant women occasionally consume alcohol [40] and in the KiGGS Wave 2 study, 10.9% of pregnant women smoked during pregnancy [41]. Furthermore, around 40% of pregnant women in Europe [42] and more than 67% of pregnant women in Germany [43] gain weight in excess of the IOM recommendations.

1.2.4 Lifestyle interventions to improve pregnancy outcomes

Due to the importance of lifestyle and weight gain during pregnancy for maternal health and pregnancy outcomes (see chapter 1.2.2) and the suboptimal health behaviours observed in pregnant women mentioned above, lifestyle intervention studies have been initiated all over the world. They build upon the increased maternal motivation to adopt healthy behaviours [32] and aim at limiting GWG and improving health outcomes by supporting maternal lifestyle during pregnancy through dietary and/or PA interventions [44,45].

Several systematic reviews and meta-analyses have been conducted to summarise the effects of antenatal lifestyle interventions on excessive GWG and pregnancy outcomes. In their systematic review and meta-analysis published in 2021, Beauchesne et al. [46] included trials conducted among generally healthy pregnant women and utilising nutrition interventions with or without exercise to controls. They found no effect of multimodal nutrition interventions on the reduction of total GWG or meeting total GWG recommendations according to the IOM but revealed a lower second and third trimester rate of GWG [46]. Furthermore, they detected no differences in the risks for caesarean delivery, preterm birth, small for gestational age (SGA), LGA and postpartum weight retention between the intervention group (IG) and control group (CG) [46]. In contrast, the recent systematic review and meta-analysis published in 2022 by Teede et al. [44], which included antenatal randomised controlled trials (RCTs) focusing on diet and/or PA based interventions with or without behavioural modification, concluded that both structured diet and PA based lifestyle interventions successfully reduced GWG. Additionally, they found these interventions to be associated with maternal and neonatal benefits [44]. Lifestyle intervention overall was associated with a reduction in GWG of 1.15 kg compared to routine care [44]. A large individual participant data meta-analysis by the International Weight Management in Pregnancy Collaborative Group [47] from 2017, which investigated the effects of diet, PA and mixed interventions in pregnancy on maternal and offspring outcomes, came to a similar conclusion. They found diet and PA based interventions to be successful in reducing GWG in the IG compared to CG (mean difference: –0.70 kg) irrespective of age, parity, maternal BMI, ethnicity or pre-existing medical condition [47]. Furthermore, they observed significantly lower odds of caesarean section, but no reduction in the risk of maternal and offspring composite outcomes [47]. A meta-review of systematic reviews published in 2021 by Fair et al. [48] examined the effectiveness of lifestyle interventions on GWG exclusively in women with overweight or obesity and included only systematic reviews based on RCTs. Their results indicated a small reduction in GWG between 0.3–2.4 kg with lifestyle interventions compared to standard care, but with a low certainty of evidence, and a reduction in the odds of GDM for dietary only or PA only interventions [48]. However, they reported no clear impact of the small reduction in GWG on maternal and infant outcomes [48]. Similar positive effects of multi-component dietary and lifestyle interventions

on GWG were reported by Farpour-Lambert et al. [49] in their evidence review of lifestyle interventions from 2018, which in contrast to Fair et al. [48] focused on women from all BMI classes [49]. They identified light to moderate intensity PA to limit GWG and balanced diets with a low glycaemic load to be associated with the greatest reduction in GWG [49]. Furthermore, they reported a decreased risk of pregnancy-induced hypertension, caesarean section and neonatal respiratory distress syndrome in women from all BMI classes following multi-component diet and PA interventions, whereas diet-based interventions seemed to decrease the risk for GDM and pregnancy-induced hypertension in women with overweight and obesity [49].

Overall, antenatal lifestyle interventions seem to have moderate positive effects on GWG and on specific pregnancy outcomes. Especially an intervention implementation in early pregnancy, personal counselling, supervised PA, a pre-determined maximal GWG goal or weight monitoring combined with a lifestyle intervention seem to be factors which contribute to the control of GWG [49] and might be promising aspects of lifestyle interventions. So far, the intervention type and delivery mode with the greatest and most reliable effect on GWG has not been identified yet. Compared to PA only interventions, dietary interventions seem to have a greater impact on GWG, but whether diet only or combined diet and PA interventions are more successful has not been determined yet [44].

Despite targeting the maternal lifestyle, only few trials focus on the effect of the interventions on maternal diet and PA behaviour next to GWG and obstetric outcomes [50,51]. According to the meta-review of systematic reviews by Fair et al. the results concerning maternal health behaviours were heterogeneous [48]. However, two large-scale trials in women with overweight and/or obesity reported improvements in maternal dietary and PA behaviours [52,53] and a smaller trial in women with normal weight found an increased diet quality but no change in physical activity [54] during pregnancy.

1.2.5 Postpartum and inter-pregnancy weight development

As shown in chapter 1.2.2, weight gain during pregnancy is associated with an increased risk of postpartum weight retention and of overweight and obesity. Therefore, it is not surprising that women who have given birth have a 3.5 times higher 5-year risk of developing obesity than women who have never given birth [55]. And of those women who had obesity within the first 2 years after childbirth, only 11% were able to return to a normal BMI within 5 years after childbirth [55]. Furthermore, inter-pregnancy weight gain, defined as the difference in weight between the beginning of the first and second pregnancy, was shown to increase the risk of maternal and perinatal complications [56]. An increase in BMI of 1 to <2 units was positively associated with pre-eclampsia, gestational hypertension, GDM and giving birth to a LGA offspring and women who gained 3 or more BMI units between pregnancies had a 63% higher

risk of stillbirth compared to women with a weight change of less than 1 BMI unit [56]. Interestingly, an increased risk of adverse pregnancy outcomes due to inter-pregnancy weight gain was also observed in women who started both pregnancies with a BMI <25 [56]. A systematic review and meta-analysis even identified women with normal weight before the first pregnancy as a high-risk population in terms of the effect of inter-pregnancy weight gain on perinatal complications [57]. This highlights the importance of weight management in the postpartum period for women in all BMI categories [57]. In contrast, weight loss between two pregnancies seems to be associated with a decreased risk of LGA in women of all BMI categories and a decreased risk of GDM in women with overweight or obesity before the first pregnancy [57].

A recent investigation identified variables which contribute to postpartum weight loss, and therefore to a return to pre-pregnancy weight, in women with obesity [58]. Gaining ≤9 kg of weight during pregnancy, undertaking moderate to high levels of PA in the postpartum period and breastfeeding exclusively for ≥4 months was associated with a higher likelihood of returning to the pre-pregnancy weight by 6 months after birth [58]. Furthermore, a healthy lifestyle after birth, just like in the general population, may improve aerobic fitness [59], insulin sensitivity [59], overall psychological wellbeing [59] and symptoms of postpartum depression [60,61] and has been associated with cardiovascular benefits [62] and a lower risk of obesity [62,63].

In the light of the risks associated with maternal inter-pregnancy weight gain, supporting women in managing their weight by achieving and maintaining a healthy lifestyle in the postpartum period is of high importance.

1.2.6 Lifestyle recommendations for the postpartum period

Specific lifestyle recommendations for women in the postpartum period mostly focus on women who are breastfeeding [64] and PA guidelines are usually embedded in the recommendations for pregnancy [64,65].

Breastfeeding women are recommended to focus on a balanced diet with adequate nutrient intakes and regular meals [64,66] to meet the additional energy requirement of 500 kcal/day when exclusively breastfeeding during the first 4–6 months [67]. Furthermore, sea fish should be consumed twice a week (at least one portion of fatty fish like salmon) and regular and sufficient hydration should be ensured [64]. Similar to the recommendations during pregnancy, breastfeeding women should avoid alcohol and smoking and supplement 100 µg/day of Iodine [64]. Generally, women are recommended to be active on a moderate intensity level during breastfeeding [64]. Depending on the mode of birth and potential complications, exercise routines can be resumed gradually after pregnancy as soon as it is medically safe [68].

However, strenuous and exhaustive exercises should be avoided [69]. Regular aerobic exercise has been shown to improve maternal cardiovascular fitness without negative effects on milk production, composition and infant growth [68,70].

Irrespective of breastfeeding status, postpartum women should follow the general guidelines for a wholesome diet for the adult population [34]. In terms of PA, women are encouraged to engage in moderate to vigorous aerobic intensity exercise for at least 150 min per week [71] similar to what is recommended for the general adult population [72]. Following an uncomplicated delivery, light exercise like stretching, pelvic floor exercises, relaxation and breathing exercises and going for a walk are deemed safe in the immediate postpartum period, whereas a moderate-intensity aerobic exercise programme should only be taken up after the first postpartum check-up and women should avoid being overly fatigued [69].

1.2.7 Barriers to a healthy postpartum lifestyle

Diet quality and PA levels have been shown to decrease or stay low in the postpartum period [73–76]. Several factors may contribute to these circumstances. For one, while pregnancy provided the opportunity to take healthy eating into consideration, the focus during the postpartum period is mostly on the baby and women may return to their old eating habits [76]. Qualitative research has revealed that women might not regard their own nutrition and exercise as a priority during this time [77–79] and that feeling overwhelmed by motherhood responsibilities [78], fatigue, a lack of time, support and motivation, cost, weather, family responsibilities, unrealistic expectations of nutrition and exercise and pregnancy-related complications may be additional challenges to a healthy lifestyle [79]. Especially the support from family may play an important role when it comes to balancing caring for the baby and reaching nutritional and exercise goals [79]. Another factor that might prevent women from engaging in PA in the postpartum period is receiving unclear advice and therefore a feeling of insecurity [80].

1.2.8 Long-term effects of antenatal lifestyle interventions

The barriers which prevent women from a healthy lifestyle postpartum and the risks associated with weight gain and weight retention clearly identify the postpartum period as a time which demands special attention and identifying lifestyle interventions which effectively improve maternal postpartum lifestyle is of particular importance. Lifestyle interventions focusing on diet and PA initiated in the postpartum period were shown to have an effect on maternal weight [62,81–83]. However, research has shown that it is difficult to engage women to modify their lifestyle during the postpartum period [84,85] and to retain women in a study [84,86], most likely due to the barriers mentioned before. Therefore, engaging women already during pregnancy, a time during which women have been shown to be motivated to change their

lifestyle [31,32], might be more constructive and the interventions might have an impact not only on lifestyle during pregnancy but also exert long-term effects on maternal postpartum health behaviour.

So far, the maternal lifestyle in the postpartum period is less of a focus regarding antenatal lifestyle interventions. Few studies have investigated the long-term effects of such interventions on maternal postpartum lifestyle and the results were heterogeneous [52,87–92]. A meta-analysis by Michel et al. showed that lifestyle interventions during pregnancy have a positive effect on postpartum weight retention [93], which might serve as a surrogate for a sustained improvement in lifestyle. However, to our knowledge, no meta-analysis has investigated the potential long-term effects of antenatal lifestyle interventions on maternal postpartum lifestyle to date and further research in this field is needed.

Therefore, one focus of this thesis is to elucidate whether a lifestyle intervention during pregnancy can sustainably improve maternal postpartum lifestyle in women with normal weight, overweight and obesity and help women overcome the barriers to a healthy lifestyle they face after birth.

1.3 Influences on child health and development

1.3.1 Consequences of childhood obesity

The increasing prevalence of overweight and obesity affects not only women in childbearing age but is also a rising concern in children all over the world as shown in chapter 1.1. These numbers are alarming, since childhood obesity is associated with breathing difficulties, hypertension, insulin resistance, early markers of cardiovascular disease, increased risk of fractures and psychological effects [1]. Additionally, a higher prevalence of neurodevelopmental disorders has been noted [94]. Later in adulthood, these children face higher chances of premature death and disability [1], and an increased risk of cancer, diabetes and coronary heart disease [95]. A meta-analysis by Simmonds et al. found a strong association between childhood obesity and adult obesity and revealed that children with obesity were more than five times more likely to be obese as adults compared to non-obese children [96]. Especially in girls, this may result in obesity at childbearing age with all the associated adverse outcomes described in chapter 1.2.2. Overall, there is a clear demand for ways to combat the rising prevalence of childhood obesity and the associated health consequences.

1.3.2 The concept of the first 1000 days

The first 1000 days, spanning from conception to almost 2 years of age, may be a critical period which sets the course for the child's development [97–99] and may present a valuable opportunity to influence child outcomes [97,98].

The "Foetal Origins of Adult Disease" and the "Developmental Origins of Health and Disease" hypotheses suggest that environmental exposures like maternal physiology, metabolism, body composition, and diet during pregnancy affect the development of the foetus by introducing permanent programmed alterations in physiological systems and thereby increase the risk for diseases in adult life [14,100–102]. Poor environmental exposures during pregnancy may be connected to an increased risk of non-communicable diseases like obesity, hypertension, type 2 diabetes, certain types of cancer, atopic conditions and neurological impairment [100]. The high sensitivity of the foetus to the maternal intra-uterine environment is due to its dependency on the provision of nutrients and oxygen from the mother through the placenta, the high speed of tissue, organ and metabolic regulation pathways maturation and finally due to a high plasticity in development which allows adaptations in response to changes in the environment [103]. Prominent examples for poor environmental exposures are under- or over-nutrition. Under-nutrition during this sensitive phase is associated with an increased risk of coronary heart disease [104] and neurological consequences [100]. Exposure to over-nutrition, mediated by maternal overweight and obesity, excessive GWG and GDM [11,105,106], seems to be connected to an increased risk of obesity, features of insulin resistance [13,107–109] and a higher risk of neurodevelopmental problems [110] in offspring. Additionally, inadequate maternal intake of micronutrients (e.g. iron, iodine, folate and Vitamin A) and macronutrients (e.g. omega-3 and omega-6 polyunsaturated fatty acids) [111] and smoking [112] during pregnancy can affect neurodevelopment in children. These associations highlight the importance of a healthy maternal weight and lifestyle during pregnancy to prevent these negative exposures. And indeed, research has shown that a normal body weight, high dietary quality, moderate to vigorous PA, no/moderate alcohol intake and no smoking during pregnancy may reduce the risk for overweight and obesity in offspring [113]. Furthermore, a better maternal diet quality [114] and specifically seafood intake [115] in pregnancy may be positively associated with cognitive and neurodevelopment. The high sensitivity of the offspring to environmental changes doesn't stop after birth but continues into the postnatal period and is reduced with the growing adaptation to the extra-uterine environment [103]. Therefore, it is not surprising that offspring development can also be influenced during the early postnatal period [102,116]. Breastfeeding presents an important factor which is thought to benefit child neurodevelopment [117] and especially cognitive and motor development [118] and may reduce the risk for offspring overweight and obesity [119]. So far, the mechanisms connecting

maternal weight and lifestyle factors to child outcomes are not fully understood [120,121], but epigenetic programming is discussed as playing an important role [121].

Overall, the associations between maternal factors and child outcomes shown above indicate that it is important to start obesity prevention and the support of child development around conception and during the perinatal period by targeting the foetal environment through maternal lifestyle [103]. Ensuring a healthy maternal weight and lifestyle around pregnancy, adequate GWG and breastfeeding may benefit not only maternal but also offspring long-term health and may help to stop the so called intergenerational cycle of obesity [16]. Therefore, effective antenatal lifestyle interventions might be a “two-for-one” solution which can support maternal and offspring outcomes at the same time.

1.3.3 Antenatal lifestyle interventions to improve child development

Several studies investigating the effects of antenatal lifestyle interventions on child outcomes have been initiated and beneficial effects on risk factors for childhood overweight and obesity have been reported [122]. However, the evidence for an effect of antenatal interventions on outcomes such as measures of adiposity seems to be limited [122,123]. A recent systematic review and meta-analysis published in 2021 by Raab et al. [124] investigated the associations between prenatal lifestyle interventions and weight or growth in childhood including data from 20 RCTs with over 11,000 participants with any BMI. They reported no effect of interventions on child weight, length, BMI, and corresponding z-scores compared to standard prenatal care irrespective of intervention content and duration in children aged between 1 month and 7 years [124]. An individual participant data meta-analysis in children aged 3–5 years published by Louise et al. in 2021 [45] came to a similar conclusion. They investigated the effects of antenatal dietary and lifestyle interventions in women with overweight or obesity on early childhood outcomes including only data from RCTs and found no effect of pregnancy interventions on childhood weight and adiposity [45].

Since maternal factors around pregnancy and in the early postnatal period are not only associated with child anthropometrics but also cognition and neurodevelopment, as shown in chapter 1.3.2, studies have also investigated the effect of antenatal lifestyle interventions with regard to child neurodevelopment. But so far, the results are heterogeneous and the number of available studies is limited [125–129]. To date, available studies investigating the effect of antenatal lifestyle interventions on child outcomes were limited by rather small sample sizes, low retention rates in the follow-ups, short follow-up periods, an inclusion of only women with overweight and obesity, the sole inclusion of women with specific risk factors, or studies conducted primarily in community settings and academic institutions [45,91,123–129].

Therefore, the second focus of this thesis will be to elucidate whether a large-scale antenatal lifestyle intervention performed alongside routine care in healthy women with normal weight, overweight and obesity can improve the anthropometric and neurodevelopment in children up to the age of 3 years.

2 Aim of the thesis

The large-scale GeliS trial ("**G**esund **l**eben **i**n der **S**chwangerschaft"/healthy living in pregnancy) which was conducted alongside routine antenatal care in Bavaria, Germany, aimed at limiting the proportion of women with excessive GWG and supporting maternal and child health and development by means of a structured lifestyle intervention programme [130].

Due to its setting in routine care as part of the public health approach and the inclusion of a large number of women with normal weight, overweight and obesity, and a pre-planned 5 year follow-up phase, the GeliS trial offers a unique chance to investigate the influences of antenatal lifestyle counselling on long-term maternal and child outcomes.

The present work focuses on two aspects regarding the long-term outcomes of the GeliS trial, which are

1) the effect of the GeliS lifestyle intervention on the maternal health behaviour in the first year postpartum and
2) the effect of the lifestyle counselling on child anthropometrics and neurodevelopment at 2 and 3 years of age.

In the following, the GeliS study design and procedures are described and the research results are summarised. Furthermore, the main outcomes of maternal health behaviour and child development are discussed and food for thought derived from the GeliS trial regarding future lifestyle intervention approaches is provided.

3 Materials and Methods

The following information on the GeliS study design and setting, the participants, the lifestyle intervention, control group and the follow-up phase has previously been published in the study protocol [130] and further publications [50,131–142], which can be referred to for additional detail.

3.1 Study design and setting

The GeliS trial is a large-scale prospective, cluster-randomised, controlled, open intervention trial aimed at improving maternal and offspring short and long-term health. The study was conducted in five administrative regions in Bavaria, a federal state of Germany. Within each of the five regions, two districts with matching birth figures, sociodemographic and geographic criteria were randomised, resulting in one intervention and one control district per region. Gynaecological and midwifery practices were recruited in the 10 districts and the recruitment of the participants as well as the lifestyle counselling was conducted within these practices alongside the German routine antenatal care system as the study was designed as a public health trial. Within each of the five regions, an expert centre for nutrition managed by the Bavarian State Ministry of Food, Agriculture and Forestry attended and supervised the practices. Further details on the design and cluster-randomisation have been published in the study protocol [130].

The primary aim of the GeliS study was to reduce the proportion of women gaining weight in excess of the IOM recommendations [35] by means of a lifestyle intervention. The primary outcome [131] as well as selected secondary outcomes, including maternal dietary behaviour [50] and PA [132] during pregnancy, dietary supplementation before, during and after pregnancy [137], short- and long-term maternal weight retention and breastfeeding behaviour [134], infant growth during the first year of life [133], and several cohort analyses [138–142] have already been published.

The study is in agreement with local regulatory requirements as well as the declaration of Helsinki. The Ethics Commission of the Technical University of Munich authorized the study protocol (project number 5653/13) and the study was registered in the ClinicalTrials.gov Protocol Registration System (NCT01958307).

3.2 Participants

As described previously [130,131], pregnant women were recruited in the 71 participating gynaecological and midwifery practices before the 12th week of gestation. Table 3 summarizes the inclusion and exclusion criteria that were applied. Women were eligible if they were 18–43

years old, had a singleton pregnancy, a pre-pregnancy BMI between 18.5 kg/m^2 and 40 kg/m^2 and a sufficient command of the German language. Furthermore, the women had to provide written informed consent to participate. Exclusion criteria were conditions which could impair the study participation, e.g. a multiple or high-risk pregnancy, pre-pregnancy diabetes mellitus or early gestational diabetes, uncontrolled chronic diseases and psychiatric or psychosomatic diseases.

Table 3 Inclusion and exclusion criteria in the GeliS trial.

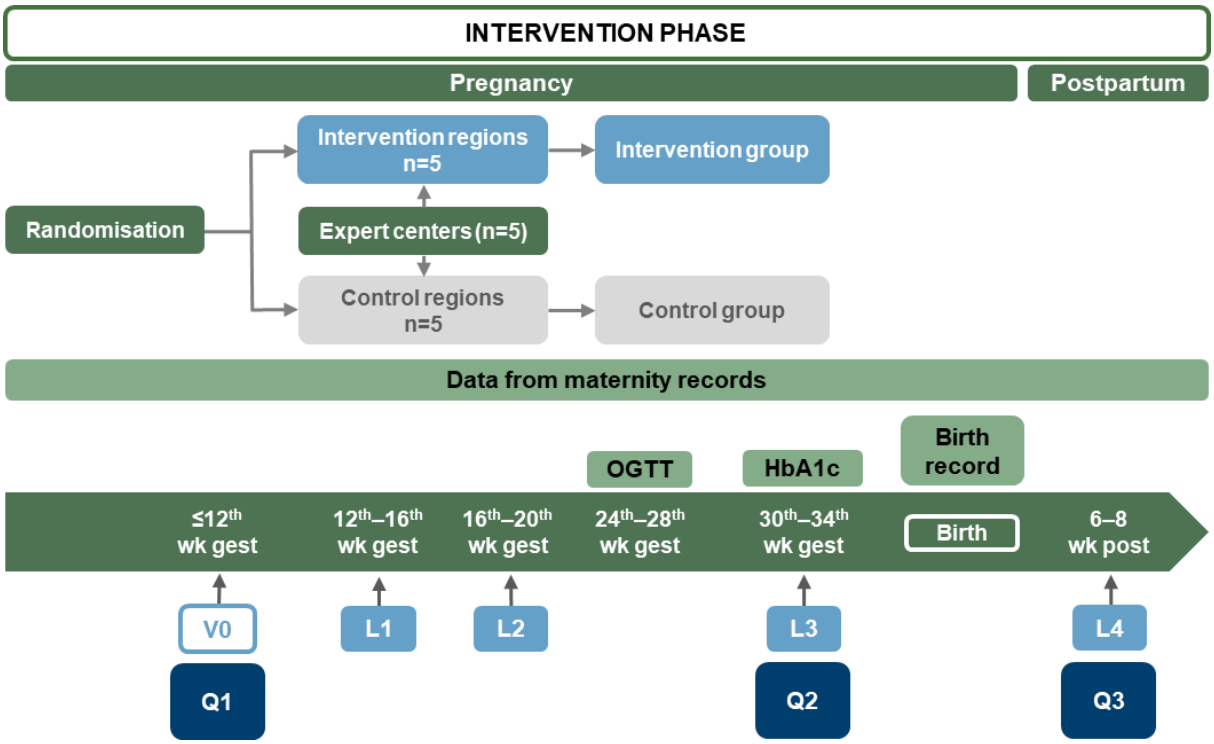
Inclusion criteria	Exclusion criteria
• Age 18–43 years • Singleton pregnancy • Pre-pregnancy BMI ≥18.5 kg/m^2 and ≤40 kg/m^2 • Sufficient German language skills • <12th week of gestation • Written informed consent	• High-risk pregnancy (e.g. contraindications to exercise) • Multiple pregnancy • Pre-pregnancy diabetes mellitus or early gestational diabetes • Uncontrolled chronic diseases (e.g. thyroid dysfunction) • Psychiatric or psychosomatic diseases • Other diseases interfering with compliance

Abbreviations: BMI: Body mass index.
Data source: created according to the GeliS study protocol [130].

3.3 GeliS lifestyle intervention

Participating gynaecologists, medical staff or midwives were previously trained to deliver the lifestyle intervention alongside the participants' routine care visits in the practices. The scheme of the intervention phase of the GeliS trial is depicted in Figure 1. The screening visit (<12th week of gestation) represented the first contact of the pregnant women to the GeliS trial, irrespective of group allocation. Eligible women were identified using a screening questionnaire and provided written informed consent to participate in the trial. Furthermore, all participants were handed questionnaires covering dietary habits, PA and mental health.

Figure 1 Scheme of the intervention phase of the GeliS trial.



Abbreviations: Wk gest: Weeks of gestation; V0: Screening visit; L: Lifestyle counselling session; OGTT: Oral glucose tolerance test; Q: Questionnaire; Wk post: Weeks postpartum.
Data source: adapted from the GeliS study protocol [130].

Successively, women from the IG received four face-to-face lifestyle counselling sessions, three during pregnancy (12th–16th, 16th–20th and 30th–34th week of gestation) and one in the postpartum period (6–8 weeks postpartum) (Figure 1). The counselling sessions had a predefined content which was based on the recommendations of the Network “Healthy Start – Young Family Network” [143].

Details on the topics of the lifestyle interventions have been published in the study protocol [130] and are summarised in Table 4. The first counselling session (12th–16th week of gestation) provided information on a healthy diet and PA during pregnancy and covered the topics healthy lifestyle, risks of alcohol, smoking and food-borne diseases, GWG, weight monitoring and critical nutrients in pregnancy. The second session was scheduled 4 weeks later (16th–20th week of gestation) and focused in more detail on individual dietary habits and PA. Furthermore, participants were informed about the opportunity to do a standardized 2-hour oral glucose tolerance test (OGTT). The third lifestyle counselling session (30th–34th week of gestation) focused on reinforcing the contents of the preceding sessions and the participants received information on prenatal maternity and postnatal exercise courses, pregnancy related conditions and the importance of breastfeeding. Additionally, glycosylated haemoglobin (HbA1c) was measured and the next set of questionnaires was handed to the participants. The fourth lifestyle counselling session (6–8 weeks postpartum) covered dietary advice during

breastfeeding, breastfeeding recommendations and infant feeding principles. The participants were handed a third set of questionnaires on the topics dietary habits, PA, post-natal depression and study evaluation.

Table 4 Counselling content of the GeliS lifestyle intervention sessions.

Visit	Time period	Content
1st counselling session	12th–16th week of gestation	• Information on healthy diet and PA during pregnancy and importance of healthy lifestyle • Risks of alcohol, smoking and food-borne diseases • GWG, weight monitoring, critical nutrients • Brochures on adequate exercise and a balanced diet during pregnancy and weight charts for self-monitoring of weight
2nd counselling session	16th–20th week of gestation	• Individual dietary and PA habits based on information from the questionnaires handed out at screening visit • Information on opportunity for standardised 2-hour OGTT
3rd counselling session	30th–34th week of gestation	• Repetition and merging of contents from the two preceding sessions • Weight monitoring • Information on prenatal maternity and postnatal exercise courses • Information on pregnancy related conditions (e.g. water retention or back problems) • Importance of breastfeeding • Measurement of HbA1c
4th counselling session	6–8 weeks postpartum	• Dietary advice during breastfeeding • Breastfeeding recommendations • Infant feeding principles

Abbreviations: PA: Physical activity; GWG: Gestational weight gain; OGTT: Oral glucose tolerance test; HbA1c: Glycosylated haemoglobin.
Data source: summarised from the GeliS study protocol [130].

3.4 Control group

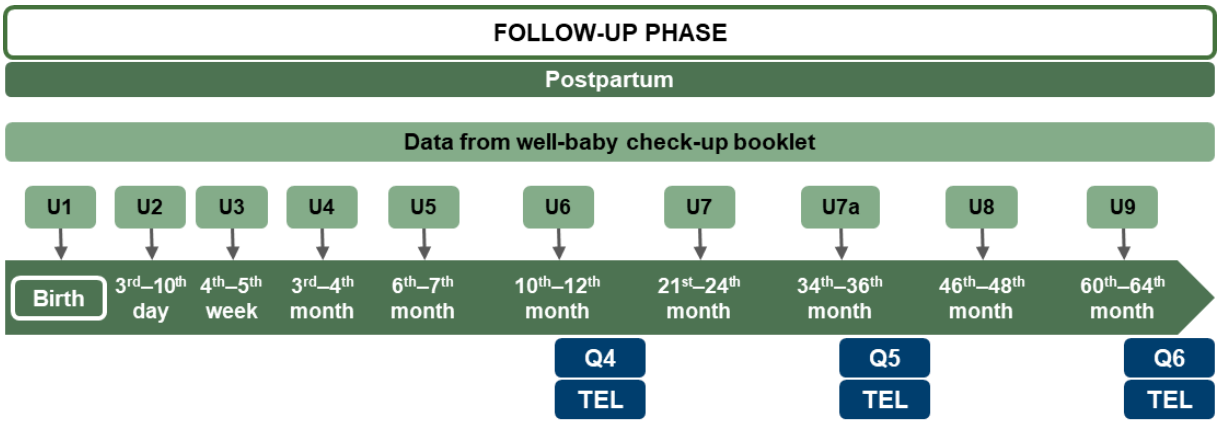
Women from the CG also took part in the screening visit described in chapter 3.3. Subsequently, they underwent routine antenatal care and only received brochures on a healthy lifestyle during pregnancy without individual advice. The OGTT, the measurement of HbA1c and distribution of the questionnaires was performed in parallel with routine visits to the gynaecological or midwifery practices and in the same time periods as in the IG (see chapter 3.3).

3.5 Follow-up phase

Subsequent to the intervention phase, participants and their offspring from the IG and CG were included in a 5-year follow-up programme (Figure 2). During that time, participants were

contacted around the 1st, 3rd and 5th birthday of their children and data on maternal health and lifestyle as well as child diet, PA and neurodevelopment were collected via questionnaires, which were sent to the participants by post. Additionally, data on child health and anthropometric development were derived from routine care. A total of 10 routinely conducted child health examinations are scheduled at defined time-points within the first 5 years of life in Germany (see Figure 2). The first 6 examinations take place in the 1st year of life (after birth, 3rd–10th day, 4th–5th week, 3rd–4th month, 6th–7th month, 10th–12th month) and the remaining 4 examinations are scheduled around the 2nd–5th birthdays of the children (21st–24th month, 34th–36th month, 46th–48th month, 60th–64th month). Physicians assess the children's anthropometric as well as age-appropriate development and document the results of these child health examinations in the standardised German well-baby check-up booklet. The study team contacted the participants around the 1st, 3rd and 5th birthday via phone and enquired the data from the well-baby check-up booklet on the examinations conducted in the 1st year of life, in the 2nd and 3rd year of life and in the 4th and 5th year of life. Participants were regarded as drop-outs during the follow-up phase if they could no longer be reached, did not provide contact details or withdrew participation [134].

Figure 2 Scheme of the follow-up phase of the GeliS trial.



Abbreviations: U: Child health examination; Q: Questionnaire; TEL: Telephone interview.
Data source: adapted from a figure previously created and used by the GeliS study team at the Institute of Nutritional Medicine, Technical University of Munich.

3.6 Data collection and processing

The collection and processing of data required for the analysis of maternal health behaviour in the first year postpartum and child anthropometrics and neurodevelopment up to 3 years of age has been published previously [50,131,132,135,136] and is described in the following.

3.6.1 Baseline and sociodemographic data

Maternal baseline and sociodemographic characteristics were collected via a short screening questionnaire before the 12th week of gestation. This included information on educational level, parity, country of birth, age, pre-pregnancy weight and height. Maternal height and pre-pregnancy weight were used to calculate pre-pregnancy BMI.

3.6.2 Maternal weight during pregnancy

The participants' weight during pregnancy was collected from the maternity records in which maternal weight is recorded during routine care visits. GWG was calculated by subtracting the measured weight at the first antenatal visit from the last measured weight during pregnancy.

3.6.3 Maternal health behaviour

Data on maternal dietary and PA behaviour as well as smoking behaviour were collected at four time-points during the study, namely in early pregnancy (before the 12th week of gestation, baseline), in late pregnancy (after the 29th week of gestation), 6–8 weeks postpartum (T1pp) and 1 year postpartum (T2pp) via questionnaires (see Figure 1, Figure 2). The questionnaires were filled out by the participants unsupervised. Data processing for maternal health behaviours during the postpartum period [135] was performed in accordance with the data processing for the data from pregnancy [50,132] and is described in the following.

Maternal dietary behaviour was elucidated using a slightly modified version of the validated food frequency questionnaire (FFQ) developed by the Robert Koch Institute, Berlin, Germany for the German Health Examination Survey for Adults (DEGS) study [144] (see Appendix A1). The applied version of the FFQ consisted of 54 questions that focused on the consumption frequency and portion size of food items and dietary behaviour over the previous four weeks. Furthermore, four questions focused on food preparation and dietary choices, the frequency of fresh food preparation and vegetarianism.

For each of the 54 food items, the participants were asked to rate the consumption frequency on a scale ranging from "never" to "more than five times per day". Portion size was determined using measures like pieces, plates, bowls, cups and glasses. The evaluation of the mean daily intake described in the following was conducted according to the scheme provided by the developers of the FFQ (personal communication: Dr. G. Mensink, Robert Koch Institute, 2018) and has been applied for the analysis of diet during pregnancy [50]. The food items were grouped into 17 food groups e.g. caffeinated beverages, soft drinks, vegetables, fruits, sweets and snacks and fast food. Over-reporting of food was assumed if very high daily intakes were reported (either liquids >15 kg or solid foods >10 kg, or both liquids >4 kg and solid foods >6 kg). In case of over-reporting or if reported amounts of more than 20 out of the 54 food items

were missing, the questionnaire was excluded from the analysis (personal communication: Dr. G. Mensink, Robert Koch Institute, 2018).

For the estimation of energy, macronutrient and fibre intake the German food composition database ("Bundeslebensmittelschlüssel") was applied using the OptiDiet PLUS software (version 6.0, GOE mbH, Linden, Germany). In case of questions that focused on more than one food item, the typical consumption distribution of these food items was derived from the German National Consumption Survey II to estimate energy and macronutrient intake (personal communication: Max Rubner-Institute; Federal Research Institute of Nutrition and Food (Bundesforschungsinstitut für Ernährung und Lebensmittel); Verzehrsmengen ausgewählter Lebensmittel aus der Nationalen Verzehrsstudie II, 2018) as applied previously [50]. As done by others [145], questionnaires were excluded from the analysis if estimated daily energy intake was unrealistically low (<4,500 kJ) or high (>20,000 kJ).

For the assessment of dietary quality, the DEGS-healthy eating index (HEI) developed by the Robert Koch Institute based on the DEGS-FFQ was calculated [146]. The DEGS-HEI [146] was used to evaluate the intake of 14 food groups according to the adherence to the DGE recommendations on a healthy diet. The scores for each food group range from 0 to 100 with higher scores indicating a better adherence to the recommendations [146]. Additionally, a combined HEI score was determined by calculating the mean group scores.

Maternal PA behaviour was assessed using the validated Pregnancy Physical Activity Questionnaire (PPAQ) [147] which targeted duration, frequency and intensity of PA behaviour (see Appendix A2). To adapt the questionnaire to German habits, the question targeting time spent sitting on a lawnmower was excluded [132]. Participants were requested to estimate the time they engaged in 32 activities during the past month. The activities can be allocated to the following categories: household/caregiving, occupational, sports/exercise, transportation and inactivity [147]. Selectable durations range from 0–6 or more hours per day and from 0–3 or more hours per week, depending on the question [147]. Additionally, two open-ended questions allowed the participants to outline two more activities that were not covered by the previous questions.

By multiplying the number of hours spent on an activity with the activity intensity, defined by the metabolic equivalent of task (MET), a measure of the average weekly energy expenditure in MET-h per week was obtained for each activity. The MET of the 32 activities listed within the PPAQ were derived from the calculation sheet of the questionnaire [148]. For the activities from the open-ended questions, corresponding MET values were determined using the 2011 Compendium of Physical Activities [149]. The sum of the average weekly energy expenditure in MET-h per week allowed an estimation of the total PA and total PA of light intensity and above (TALIA), respectively. Additionally, the PPAQ allows the grouping of the average weekly energy expenditure of activities according to activity type (household/caregiving, occupational,

sports/exercise, transportation and inactivity) or activity intensity (sedentary (MET <1.5), light (MET ≥1.5 and <3.0), moderate (MET ≥3.0 and ≤6.0) and vigorous (MET >6.0)) [148]. Additionally, participants were classified regarding their compliance with national and international PA recommendations [72,150]. For meeting the recommendations, a threshold of ≥7.5 MET-h per week in sports activities of moderate intensity was set as recommended by the PPAQ developer (personal communication: Prof. L. Chasan-Taber, University of Massachusetts Amherst, 2018) and applied for the analysis of pregnancy PA [132].
As done by others [52] and in accordance with the analysis of PA during pregnancy [132], questionnaires were excluded due to over-reporting if the number of hours reported in the PPAQ per week was higher than the total number of hours in a week. Questionnaires with unrealistically high reports for occupational activity (>12 h per day for 7 days per week) were also excluded from the analysis [132].

Maternal smoking behaviour was determined via the question 'Do you currently smoke?'. The data of all four time-points was considered in the analysis.

3.6.4 Offspring anthropometric data

Infant anthropometrics at birth as well as the exact birth date were collected from the birth records.

Child weight, height, head circumference and the examination date at 2 and 3 years of age stemmed from the well-baby check-up booklet as described in chapter 3.5. The health examinations were conducted at the age of 21–24 months and 34–36 months. Weight and height were used to determine the children's BMI. Age- and sex-specific percentiles and z-scores for weight, height and BMI were calculated using a German reference group [151]. By subtracting the birth date from the examination dates, the children's exact age at the two examinations was calculated. Missing examination dates were circumvented by using single imputation. Based on BMI-for-age-percentiles from German recommendations, offspring was grouped as being underweight (< 10.0th percentile), overweight (> 90.0th percentile) or obese (> 97.0th percentile) [151].

3.6.5 Offspring neurodevelopment

Data on offspring neurodevelopment were collected at 3 years of age using the German 36 months version of the Ages and Stages Questionnaire (ASQ-3^{TM}) (ASQ). The ASQ is a parent completed developmental screening tool [152], which was sent to the participants per post and filled out unsupervised by the mother-child pairs. It consists of five developmental domains, namely Communication, Gross motor, Fine motor, Problem-solving and Personal-social. Within each domain, there are 6 questions concerning the child's age-appropriate development. Each question focuses on a task or behaviour of the child and can be answered

either “yes” if the task is mastered frequently by the child (10 points), “sometimes” if the task is not yet mastered frequently (5 points) or “no” if the task is not mastered yet (0 points). The points achieved in the questions within a domain are summed up for each child as described in the user’s guide [153] and done by others [118,128], and a higher score indicates a closer to age-appropriate development in that domain. In case of missing data in a domain, the mean value of the non-missing questions was inserted if ≤2 questions were left unanswered. In case of >2 missing questions, the domain was excluded from the analysis.

Furthermore, the scores achieved in each domain were evaluated using pre-defined cut-off values provided by the questionnaire. The cut-off values per domain for the 36 months version of the ASQ are depicted in Table 5. A score below the cut-off values in a domain indicated a potential delay in development in that particular area [153].

The child’s exact age at completion of the questionnaire was calculated by subtracting the birth date from the ASQ completion date. In accordance with the approach for the examination dates described above, single imputation was applied in case of missing questionnaire completion dates.

Table 5 Cut-off values for the evaluation of ASQ scores in the 36 months version of the questionnaire.

Developmental domains	Cut-off values
Communication	30.99
Gross motor	36.99
Fine motor	18.07
Problem-solving	30.29
Personal-social	35.33

Data source: adapted from the German 36 months version of the Ages and Stages Questionnaire (ASQ-3^{TM}).

3.7 Statistical analysis

In the GeliS trial, the power calculation was conducted for the primary endpoint excessive GWG and was described in the study protocol [130]. The statistical approach for the analysis of maternal postpartum health behaviour and child development has been published previously [135,136] and is summarised in the following.

Participants were included in the analysis of maternal lifestyle in the first year postpartum if they filled out the diet and/or PA questionnaire at T1pp and/or T2pp and were not pregnant at T2pp. For the analysis of smoking behaviour, the same prerequisites applied and the women had to provide data on their smoking behaviour. For the analysis of child development at 2 and

3 years of age, mother-child pairs were included if data on child anthropometrics and/or neurodevelopment were provided.

Table 6 gives an overview of the statistical models and adjustment factors used to analyse the individual outcome variables. Linear or binary logistic regression models fit with generalised estimating equations (GEEs) were applied to analyse group differences in diet and PA variables and smoking behaviour (Table 6) as described by Donner et al. [154]. For the assessment of changes in dietary and PA behaviours between T1pp and T2pp, linear mixed models for repeated measures were applied (see Table 6). Additionally, selected diet and PA variables were analysed according to maternal age, pre-pregnancy BMI category, educational level and parity in exploratory subgroup analyses.

Child anthropometric outcomes as well as age- and sex-specific percentiles and z-scores were analysed using likelihood-based mixed models for repeated measures as described by Bell et al. [155] (Table 6). These models included all data available from child health examinations from the 1st to the 3rd year of life and group differences at 2 and 3 years of age were analysed using customised hypotheses. Visit number and group assignment as well as their interaction were included to obtain point estimates and 95% confidence intervals (CI) for the mean differences between IG and CG. Results of the analyses on group differences in child anthropometrics in the 1st year of life have been published previously [133]. Between-group differences in weight categories, based on BMI-for-age percentiles, at 2 and 3 years of age were determined applying proportional odds ordinal logistic regression models fit with GEEs (Table 6). Linear/binary logistic regression models fit with GEEs were applied for the analysis of group differences in child ASQ scores and ASQ score evaluation (Table 6). Deviations of the children's age from the target range for the child health examinations and the completion of the ASQ were observed. To account for that, the exact age at the examinations and the completion of the ASQ was included as an adjustment factor (Table 6).

All analyses were performed using SPSS software (IBM SPSS Statistics for Windows, version 26.0, IBM Corp, Armonk, NY, USA) and *p*-values were considered statistically significant if <0.05.

Table 6 Overview of statistical models and adjustment factors used in the analyses.

Outcome	Statistical model	Adjustment factors
Maternal postpartum health behaviour		
Group differences in continuous diet and PA variables	Linear regression models fit with GEEs	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity, baseline dietary or PA assessment, time interval between questionnaire completion date and birth date of the child
Group differences in dichotomised diet and PA variables	Binary logistic regression models fit with GEEs	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity, baseline dietary or PA assessment, time interval between questionnaire completion date and birth date of the child
Changes in dietary and PA behaviours between T1pp and T2pp (time effects)	Linear mixed models for repeated measures	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity
Group differences in smoking behaviour	Binary logistic regression models fit with GEEs	Early pregnancy: Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity Late pregnancy: additionally baseline smoking assessment T1pp and T2pp: additionally time interval between questionnaire completion date and birth date of the child
Group differences in selected dietary, PA and smoking variables in subgroups	Linear/binary logistic regression models fit with GEEs	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity, baseline dietary/PA/smoking assessment, time interval between questionnaire completion date and birth date of the child
Child anthropometrics and neurodevelopment		
Group differences in child anthropometric outcomes	Likelihood-based mixed models for repeated measures	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity, child sex, child age in days at the corresponding visit, study region
Group differences in child age- and sex-specific percentiles and z-scores	Likelihood-based mixed models for repeated measures	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity, study region
Group differences in weight categories based on BMI-for-age percentiles	Proportional odds ordinal logistic regression models fit with GEEs	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, parity
Group differences in ASQ scores	Linear regression models fit with GEEs	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, maternal educational level, parity, child sex, child age in months at completion of the ASQ
Group differences in ASQ score evaluation	Binary logistic regression models fit with GEEs	Maternal pre-pregnancy BMI category, maternal pre-pregnancy age, maternal educational level, parity, child sex, child age in months at completion of the ASQ

Abbreviations: GEEs: Generalised estimating equations; BMI: Body mass index; T1pp: 6–8 weeks postpartum; T2pp: 1 year postpartum; ASQ: Ages and Stages Questionnaire (ASQ-3™).
Data source: summarised from [135,136].

4 Results

In the following, the main results on the effect of the GeliS lifestyle intervention on maternal postpartum health behaviour [135] and child anthropometrics and neurodevelopment [136] are summarised.

4.1 Effects of the GeliS lifestyle intervention on maternal health behaviour in the first year postpartum

Title: Effects of a Prenatal Lifestyle Intervention in Routine Care on Maternal Health Behaviour in the First Year Postpartum – Secondary Findings of the Cluster-Randomised GeliS Trial.

Authors: Kristina Geyer*, **Monika Spies***, Julia Günther, Julia Hoffmann, Roxana Raab, Dorothy Meyer, Kathrin Rauh, Hans Hauner

*These authors contributed equally to this work and share first authorship.

Access: Nutrients, 2021, 13, 1310; open access article available from: https://www.mdpi.com/2072-6643/13/4/1310/htm.

Summary of findings: The aim of this secondary analysis was to investigate the lasting effect of a prenatal lifestyle intervention, conducted alongside routine care, on maternal dietary, PA and smoking behaviour during the first year postpartum. Additionally, the changes in dietary intake and PA from 6–8 weeks postpartum (T1pp) to 1 year postpartum (T2pp) were analysed.

From the originally recruited 2286 participants, 1899 participants provided data on their lifestyle at T1pp and/or T2pp. Women from the IG had a slightly lower mean intake of fast food (T1pp: adjusted effect size -2.25 g/day, CI -4.08 to -0.42, $p = 0.016$; T2pp: adjusted effect size -4.09 g/day, CI -5.36 to -2.82, $p < 0.001$) and soft drinks (T1pp: adjusted effect size -72.44 ml/day, CI -107.00 to -37.88, $p < 0.001$) and a higher consumption of vegetables (T2pp: adjusted effect size 17.90 g/day, CI 3.53 to 32.27, $p = 0.015$) compared to women from the CG. Additionally, participants from the IG were more likely to choose healthy oils like rapeseed and olive oils for the preparation of meat and fish (T1pp: $p = 0.004$; T2pp: $p = 0.011$) and for the preparation of vegetables (T1pp: $p = 0.012$). The diet quality, evaluated by the HEI, of women from the IG was higher by trend at T1pp ($p = 0.093$) and significantly higher at T2pp ($p = 0.043$) compared to women from the CG. However, there was no evidence for a difference in total energy and macronutrient intake between the groups. Over the course of the postpartum period, dietary quality as well as the consumption of vegetables increased while the intake of sweets and snacks decreased in both groups. In terms of PA, women from the IG reported a significantly higher level of occupational activity ($p = 0.016$) and lower total PA ($p = 0.023$) at T1pp compared to the CG. No further differences were observed between the IG and CG for activity

types or intensities except for a trend for a higher proportion of women meeting the physical activity recommendations at T1pp in the IG (p = 0.060). Over the course of the postpartum period, the level of inactivity and the mean MET-h per week in sedentary activity decreased significantly (p <0.001 in both groups) while the levels in most other types of PA increased irrespective of group allocation. Smoking rates were found to be comparable between the IG and CG in early pregnancy (5% in each group). During pregnancy, the proportion of smokers decreased in the IG but not in the CG, resulting in a significantly fewer smokers in the IG in late pregnancy (IG: 3.8%, CG: 5.1%, p <0.001). In the postpartum period, smoking rates continued to be lower in the IG compared to the CG (T1pp: 7.1% vs. 9.7%, p <0.001; T2pp: 13.1% vs. 14.1%, p <0.001), despite an increase in the proportion of smokers after birth in both groups.

In conclusion, the results indicated slightly positive intervention effects beyond the intervention phase on maternal dietary as well as smoking behaviour, whereas no comprehensive influence on PA was detected.

Personal contribution: **Monika Spies,** together with the other first author, designed the research question for the article, performed the statistical analysis, created the tables and figures, interpreted the data and wrote the final manuscript. Regarding the performance of the statistical analysis, the focus of **Monika Spies** was on the dietary and smoking data and the focus of the other first author was on the physical activity data.

4.2 Effects of the GeliS lifestyle intervention on child anthropometrics and neurodevelopment at 2 and 3 years of age

Title: Child Anthropometrics and Neurodevelopment at 2 and 3 Years of Age Following an Antenatal Lifestyle Intervention in Routine Care – A Secondary Analysis from the Cluster-Randomised GeliS Trial.

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Summary of findings: The aim of the analysis was to elucidate potential long-term effects of the GeliS lifestyle intervention on offspring anthropometrics and neurodevelopment up to 3 years of age.

Of the originally recruited 2286 study participants, 1644 mother-child pairs (IG: 837, CG: 807) provided data on child anthropometrics and/or neurodevelopment in the 3-year follow-up. No

significant difference in mean weights of children from the IG and CG was detected at 2 and 3 years of age (2 years of age: IG 12.30 ± 1.44 kg vs. CG 12.26 ± 1.37 kg, $p = 0.176$; 3 years of age: IG 14.58 ± 1.73 kg vs. CG 14.54 ± 1.72 kg, $p = 0.166$). Similarly, mean height, mean BMI, mean head circumference as well as weight, height and BMI percentiles and z-scores were comparable between the groups at both time points. The proportion of children in the different weight categories, ranging from underweight to obesity, were similar in the IG and CG at 2 years of age, whereas children from the IG had by trend slightly higher odds of being in a higher weight category at 3 years of age (adjusted odds ratio 1.17, CI 0.99 to 1.37, $p = 0.062$). The children's ASQ scores, which were used to assess neurodevelopment at 3 years of age, showed no significant differences in the domains Communication, Gross motor, Fine motor and Personal-social, however, children from the IG had slightly lower scores in Problem-solving (IG: 54.3 ± 8.1, CG: 54.9 ± 7.2; $p < 0.001$). Similarly, the proportion of children with ASQ scores below cut-off, indicating a potential delay in development in that area, was comparable for Communication, Gross motor and Personal-social. However, children from the IG were less likely to have a Fine motor score below cut-off (adjusted odds ratio 0.45, CI 0.28 to 0.74, $p = 0.002$) and more likely to have a score below cut-off in Problem-solving (adjusted odds ratio 2.07, CI 1.45 to 2.95, $p < 0.001$) than children from the CG.

In conclusion, there was no evidence for a long-term effect of the GeliS lifestyle intervention, conducted alongside routine care, on child anthropometrics at 2 and 3 years of age and on child neurodevelopment at 3 years of age. Further studies utilising innovative lifestyle intervention approaches might be able to fill the knowledge gap of how to positively influence child health in the long-term.

Personal contribution: **Monika Spies** was in charge of the data collection and data processing, designed the research question for the article and was responsible for the statistical analysis. **Monika Spies** created the tables and figures, interpreted the data and wrote the final manuscript.

5 Discussion

To the best of our knowledge, the cluster-randomised controlled GeliS trial is one of the largest antenatal lifestyle intervention trials performed in a public health approach. However, the intervention was not successful in reducing the proportion of women with excessive GWG nor in affecting the risk of developing GDM or further maternal and offspring outcomes [131]. Nonetheless, the intervention resulted in an improvement of certain aspects of maternal dietary [50] and PA behaviour [132] during pregnancy, in the rate of exclusive breastfeeding [134] as well as in slight changes in maternal postpartum weight development [134]. No effect could be demonstrated on relevant postpartum weight retention (>5 kg) [134], nor was there evidence for a substantial influence on infant anthropometrics or the pattern of complementary feeding in the first year of life [133].

The aim of the current work was to investigate the long-term effects of the GeliS lifestyle intervention conducted alongside routine antenatal care in women with normal weight, overweight and obesity on the maternal health behaviour in the first year postpartum [135] and on child anthropometrics and neurodevelopment in the 2nd and 3rd years of life [136]. In the following, the main results will be discussed with regard to the current state of research. Additionally, general considerations derived from the GeliS trial will be presented which may be relevant for the development of future trials.

5.1 Intervention effects on maternal health behaviour

The GeliS lifestyle intervention was found to have slightly positive effects on maternal dietary and smoking behaviour up to 1 year postpartum [135]. Women from the IG were less likely to smoke and had a slightly lower consumption of fast food and soft drinks and a higher intake of vegetables in the postpartum period [135]. The use of healthy oils for the preparation of meat and fish or vegetables was more prevalent and the overall diet quality was slightly higher in the women who received the lifestyle intervention programme [135]. These results are consistent with our observations from pregnancy in which the GeliS lifestyle intervention was found to improve aspects of the maternal diet like the use of healthy oils and the consumption of fish, vegetable and soft drinks [50] as well as smoking behaviour [135]. The consistency in the observed differences between the IG and CG implies that the GeliS lifestyle intervention was indeed able to slightly improve maternal diet and to decrease the rate of smoking in the long-term. However, the clinical relevance of our findings are unknown, as the changes in maternal health behaviour were small and with regard to diet did not extend to differences in mean energy intake between the groups [135].

There was no evidence for a comprehensive effect of the intervention on maternal PA behaviour in the 1st year postpartum, but we observed a trend for a higher proportion of women meeting the PA recommendations in the IG at T1pp [135]. These results are disappointing in the light of an improved PA behaviour in the women of the IG during pregnancy [132] and might indicate that, at least in terms of PA, pregnancy might be a window of opportunity for short-time behaviour change, but not necessarily for long-term improvements lasting into the postpartum period [32]. Qualitative studies have shown that in order to be able to maintain an improved PA behaviour women should receive continued or extra support in the postpartum period [32,156]. The GeliS lifestyle intervention, and therefore the support for the IG, ended at 6–8 weeks postpartum [130], which may explain why the above mentioned trend for an improved PA behaviour observed in the early postpartum period disappeared by 1 year postpartum.

The results from two comparable large-scale antenatal intervention trials on the maternal lifestyle in the postpartum period are heterogeneous and focus only on women with overweight and/or obesity [52,91,92] as indicated previously [135]. The results of the Australian LIMIT trial, which originally recruited 2212 women [52], diverge partially from our findings. Dodd et al. [52] reported that at 4 months postpartum the improvements in dietary and PA behaviour that were observed during pregnancy were mostly not maintained and that the diet quality was comparable between the IG and CG. The lack of lasting improvements in dietary behaviour is interesting, since the LIMIT intervention was more intensive in terms of the number of intervention sessions and applied behavioural strategies [157] and intervention intensity has been proposed to be a moderator of effectiveness at least in the prevention of GDM [158]. Nevertheless, the women entered the LIMIT trial at a later stage of pregnancy (mean gestational age in weeks at entry: 14.1) [159] than in the GeliS trial (mean gestational age in weeks at entry: 8.3) [131], which might be connected to more short-term effects of the intervention, since there is less time for a new habit formation [160]. And similar to the intervention intensity, an early intervention initiation has been proposed as an effectiveness moderator, at least in terms of GDM prevention [158] and also in terms of control of GWG [49]. In contrast to the GeliS study, the LIMIT study offered additional structured walking sessions in a nested component of the trial to a subgroup of the IG and found no differences in PA behaviour between the women who received the additional active walking sessions and those who received only the intervention sessions [52]. These results indicate that interventions including an active PA component in addition to counselling might not necessarily yield greater lasting effects on PA behaviour in the postpartum period. However, it should be noted that these results may not be entirely reliable since only 14% of the women that were randomised to the additional walking group attended at least one walking session [52]. Similar to our results, the UPBEAT trial, which recruited 1555 women in the UK [53] and focused on reducing

the risk of GDM and delivery of LGA infants [161], reported lasting effects of a complex behavioural antenatal lifestyle intervention on maternal diet at 6 months [92] and 3 years [91] postpartum but not on PA behaviour [91,92] following improvements in dietary and PA behaviour during pregnancy [53]. These improvements in maternal diet, which were maintained at 3 years postpartum may indicate a fundamental and lasting impact of the intervention on the participants. In contrast to the 4 counselling sessions in the GeliS trial [130], the UPBEAT behavioural intervention consisted of 8 contact sessions with a health trainer, each lasting 1–1.5 hours, and focused on improving maternal glycaemic control [161]. Interestingly, the UPBEAT study was effective in achieving long-term improvements in maternal diet despite including women as late as between 15^{+0}–18^{+6} weeks of gestation [161], however, the high number of contact sessions and the complex intervention content [161] may have counterbalanced the shorter time left for influencing the lifestyle.

Overall, both the GeliS and the UPBEAT trial successfully introduced lasting but moderate improvements in maternal dietary behaviour, and neither the GeliS, LIMIT nor UPBEAT interventions were able to achieve lasting effects on PA in the postpartum period. As mentioned above, a recent qualitative study of women's postnatal PA decision-making concluded that without support women have difficulties in sustaining sufficient motivation and perceiving their capacity for PA [156]. Unlike the LIMIT [157] and UPBEAT [161] interventions, the last GeliS counselling session was indeed scheduled at 6–8 weeks postpartum [130], but women probably need more support in the postpartum period than one session can provide and interventions, which span well into the postpartum period, might be needed.

The GeliS lifestyle intervention successfully lowered the proportion of smokers during pregnancy and in the postpartum period and thus demonstrated lasting effects on maternal smoking behaviour [135]. Unfortunately, neither the LIMIT nor UPBEAT trial, nor any other comparable study to our knowledge reported on the effect of their lifestyle intervention on maternal smoking behaviour in the postpartum period. Sohlberg and Bergmark [162] investigated the influence of lifestyle for long-term smoking cessation in adult men and women who successfully quit smoking. They found that 160 of the 581 participants (32.4%) had generally adopted a healthier lifestyle and about half of them had also continued with physical exercise [162]. The authors suggested that an overall healthier lifestyle may increase the chances for a long-term smoke-free life by alleviating withdrawal symptoms, contributing to a positive mood and well-being and preventing weight gain [162]. With regard to the GeliS study, this could mean that while the counselling during pregnancy motivated women to quit smoking, the long-term improvements in maternal health behaviours, described above, supported the women in staying long-term smoke-free in the postpartum period.

5.2 Intervention effects on child outcomes

There was no evidence for an effect of the GeliS lifestyle intervention on child anthropometric and neurodevelopmental outcomes at 2 and 3 years of age [136]. Child weight, height, head circumference and BMI as well as the respective z-scores and percentiles were comparable between the IG and CG [136]. Similarly, the ASQ scores and the proportion of children with a higher risk for a potential delay in the individual domains of the ASQ were overall similar between the two groups [136]. These results were in line with our analysis of the anthropometric development during the first year of life [133] which similarly found no effect of the intervention on child anthropometrics. The results from other large-scale trials [91,127] as well as from two recent meta-analysis published in 2021 [45,124] on the effects of antenatal lifestyle interventions conducted in women with overweight and obesity [45] and in women from all BMI categories [124] on child outcomes are largely in agreement with our findings, as outlined previously [136]. Both the LIMIT [127] and the UPBEAT [91] trial reported no lasting effects of their antenatal lifestyle interventions on child growth and adiposity at 3–5 and 3 years of age, respectively. Measures of skinfold thickness, which are not measured as part of the child health examinations in Germany and could therefore not be investigated in the GeliS trial, were reported to be comparable in children from the IG and CG in the UPBEAT trial [91]. Similar to the GeliS trial, the LIMIT trial investigated child neurodevelopment at 3–5 years of age using the ASQ and found no persistent intervention effects [127]. Two smaller trials with available data on less than 100 children per study arm that investigated the effects of lifestyle interventions on child neurodevelopment reported more heterogeneous results [128,129]. Menting et al. [128] reported no differences in neurodevelopment in children aged 3–6 years between the IG and CG in a subsample of participants from the RADIEL and LIFEstyle trials. Conversely, Braeken and Bogaerts [129] detected less surgency/extraversion in children aged 3–7 years born to mothers with obesity which were allocated to the brochure-based lifestyle intervention arm compared to both the routine antenatal care and the prenatal session group. However, due to the utilisation of a different questionnaire compared to the other trials mentioned above which focused on offspring temperament, the comparability of the results of Braeken and Bogaerts [129] is limited.

The absence of an impact of antenatal lifestyle interventions on child outcomes might be connected to a lack of effect [131,159] or small effect [53] of the interventions on GWG as outlined previously [136]. Since the risk for childhood overweight has been shown to increase over the full range of GWG [107], interventions achieving substantial reductions in GWG might be necessary for notable effects on child development. This was also hypothesised in the meta-analysis by Raab et al. [53]. Furthermore, the effect of GWG on child outcomes may vary with maternal pre-pregnancy BMI. Voerman et al. [107] showed in their individual participant

data meta-analysis that while both pre-pregnancy BMI and GWG are associated with a higher risk of offspring overweight and obesity, the additional effect of GWG in women with overweight or obesity is small. Especially in trials that only included women with overweight and obesity, potential beneficial effects of small reductions in GWG on child outcomes may therefore be obscured by the stronger adverse effects of maternal BMI. And indeed the risk of overweight/obesity in the offspring of women with overweight/obesity has been shown to be increased irrespective of GWG [107]. Therefore, it might be important for future trials to focus on maternal weight status before pregnancy in addition to limiting weight gain during pregnancy to improve child outcomes [107]. The timing of the intervention could in general increase the effectiveness of lifestyle interventions on child outcomes and this is discussed in more detail in chapter 5.3.1. Next to antenatal influences, the home environment and family life affects behaviours related to the obesity risk [163] and may pose an important confounding factor. Research has shown that differences in family lifestyle are accounted for by family background characteristics like socio-economic status, maternal education and family structure and that family lifestyle seems to mediate the relationship between childhood adiposity and family background [164]. The differences in lifestyle in advantaged and disadvantaged families are related to the prevalence of childhood obesity [164]. Additionally, as mentioned before [136], there are indications that maternal pregnancy diet quality may be associated with improvements in offspring neurodevelopment only in children from less optimal home environments [165]. To our knowledge, most studies did not evaluate family background characteristics after birth and in early childhood. Including these characteristics in future analyses may allow to account for deviations in the home environment and reveal a clearer view on the effect of antenatal interventions on child development.

5.3 Considerations for future trials

The GeliS trial has a very unique design and setting as it was conducted alongside routine antenatal care visits and its strength lies within the large sample size [131], the inclusion of women from several BMI categories [130], the pre-planned long-term follow-up period [130] and the utilization of maternal and offspring data from primary care health records [131,136]. Furthermore, the GeliS trial had a very high retention rate in the follow-up phase with 71.9% of the original participants providing data up to the children's 3rd birthday [136]. Nonetheless, the effectiveness of the GeliS lifestyle intervention was limited [50,131–136]. It is not possible to determine the reasons behind this, especially since the most effective types of interventions, also in terms of contact frequency and level of supervision during the intervention, have not been identified yet [48]. However, several aspects which may have contributed to the moderate successfulness of the GeliS lifestyle intervention and which should be considered in future trials were elucidated with regard to the literature and are discussed in the following.

5.3.1 Timing of the intervention

The first counselling session of the GeliS lifestyle intervention was set to take place between the 12th and 16th week of gestation [130]. Similarly, other antenatal lifestyle intervention studies commenced at the end of the first trimester or later [46]. However, this might already be too late to affect maternal and child outcomes.

In terms of GWG, Beauchesne et al. [46] found significant effects of interventions on weight gain during the second and third trimester but not on total GWG. The authors suggest that the effect of interventions that start after the first or even at some point during the second trimester is not enough to influence total weight gain, since total GWG includes the weight gained during the first trimester before the start of the interventions [46]. However, Poston et al. [53] have shown an effect of an antenatal lifestyle intervention starting during the second trimester on total GWG. Therefore, it can be assumed that the influence on total GWG depends not only on the starting point, but also on the strength and intensity of the intervention programme itself. Nonetheless, starting future lifestyle interventions during the first trimester or even earlier might increase the effect on GWG.

Furthermore, the preconception period and early pregnancy have been identified as critical periods in relation to pregnancy complications and maternal and offspring health outcomes [120,166]. During this time, the development of the placenta and foetal organs take place [166]. Therefore, interventions which begin after the first trimester are potentially unable to improve pregnancy and long-term health outcomes as the foetus has already been exposed to an potentially adverse metabolic environment and suboptimal development has started from conception onwards [166,167]. This might explain why the GeliS trial [50,132] and comparable lifestyle interventions which improved maternal lifestyle [52,53] do not seem to have strong effects on birth outcomes and offspring health outcomes [53,125,126,131,133,136,159,166], despite the fact that a healthy maternal lifestyle has been shown to be associated with a reduced risk of adverse offspring outcomes [113]. Interventions starting in the preconception period increase the time women are exposed to positive lifestyle behaviours and might be connected to a higher likelihood of these behaviours being maintained [160].

Overall, it seems that the preconception period, instead of or even in addition to pregnancy, might be a promising starting time for future lifestyle intervention studies aimed at improving maternal and child outcomes and this has also been proposed by Fair et al. [48]. Studies in the preconception period are difficult, both due to unplanned pregnancies [48] and due to the naturally varying time frame between planning a pregnancy and becoming pregnant which makes it difficult to recruit participants. Interestingly, weight loss in close proximity to conception may be associated with an increased risk of metabolic diseases in the offspring [120] as well as SGA and preterm birth [168]. Therefore, focusing on an improvement of diet

quality instead of weight loss may help to lessen obesity associated adverse health outcomes in children [120]. Nonetheless such studies might have a high effectiveness, since Murray-Davis et al. [79] found that healthy lifestyle routines which are established before pregnancy help to achieve appropriate GWG and to maintain health through pregnancy and postpartum. Furthermore, if lifestyle interventions in the preconception period are shown to be effective, this might support the implementation of lifestyle counselling for all women in childbearing age as part of routine care [169] which could be an important step in combating the rising prevalence of obesity.

5.3.2 Delivery mode of lifestyle counselling

In the GeliS study, previously trained gynaecologists, medical staff or midwives delivered face-to-face lifestyle counselling in the participating gynaecological and midwifery practices. This decision was made since the lifestyle intervention was supposed to represent a true public health approach and to allow for an immediate implementation in routine care if the intervention was shown to be effective [130]. Therefore, counselling had to be delivered by personnel who are usually involved in the routine care of pregnant women. However, the busy day-to-day schedule in the practices may have made it difficult to find the appropriate time to deliver the counselling sessions with the necessary tranquillity and time [131]. Furthermore, trained dietitians and physiotherapists, who are experts in supporting people to improve their lifestyle, might have been able to counsel women more effectively and in more depth compared to medical personnel who received a predefined curriculum for the counselling and two days of seminar for preparation [131]. Both the lack of time and the delivery of the lifestyle counselling by non-experts may have contributed to the limited effectiveness of the GeliS lifestyle intervention. This hypothesis is supported by the pilot study FeLIPO which reported a significantly lower proportion of women exceeding the IOM recommendations in the intervention group compared to the control group following two antenatal lifestyle counselling sessions conducted alongside routine care visits [170]. In contrast to the GeliS trial, trained researchers delivered the lifestyle counselling in the FeLIPO study [170] which may have accounted for the stronger intervention effect. Similarly, Barroso et al. [171] reported the delivery of successful lifestyle interventions by trained intervention staff, e.g. dietician, lifestyle coach and physiotherapist, in their scoping review on efficacious lifestyle interventions for appropriate GWG in women with overweight and obesity set in the health care system. According to their results, successful lifestyle interventions should furthermore include frequent contact with the intervention staff and consider motivational interviewing techniques, self-monitoring strategies and telehealth delivery modalities [171]. A recent systematic review focused on mobile phone-based behavioural interventions in pregnancy and found interventions which used a multimodal intervention, meaning the combination of an app or text message with another method of communication (e.g. social media or email), to be successful

in limiting GWG [172]. Especially in the setting of routine care, such smartphone-based multimodal interventions might be easier to implement than the delivery of an intervention by dieticians and physiotherapists who do not routinely work in gynaecological practices in Germany. Smartphone-based interventions are easily accessible to all women irrespective of socio-economic status and, provided they contain practical information and advice in a concise format, are valued by participants [173].

5.3.3 The control group

In clinical trials, the choice of an adequate CG is an important decision [174]. In the GeliS trial, the cluster-randomised design obviated spill-over effects of the intervention content from participants of the IG to the participants of the CG and the groups were comparable apart from a higher proportion of nulliparous women in the IG [131]. Unfortunately, there is always the risk that by the mere knowledge of participating in a trial, participants of the CG might change the behaviour under investigation and e.g. improve their health behaviours alongside the intervention group [175]. Such changes are difficult to avoid since participants have to give an informed consent to participate in a clinical trial [176]. Changes over time in individual aspects of dietary and PA behaviour were also noted in the CG of the GeliS trial during pregnancy [50] and in the postpartum period [135], which might be solely due to study participation. Furthermore, trials are confronted with the balancing act between motivating the participants of the CG to keep taking part and avoiding the provision of an incentive for lifestyle change. In the GeliS trial, the CG received general information flyers on a healthy lifestyle in pregnancy in addition to routine care [131], as an incentive and motivation to keep participating. A recent investigation by Braeken and Bogaerts [129] found that passive interventions using brochures might be more effective in changing maternal lifestyle than brochures combined with active intervention sessions, as mentioned previously [136]. One reason for this observation might be that the brochures might be connected to a higher intrinsic motivation, whereas the active intervention sessions might feature a more extrinsic motivation to change the lifestyle [129]. Potentially due to this higher intrinsic motivation, women receiving passive forms of interventions might also revert to their original lifestyle more slowly than women receiving active intervention sessions [129]. Interestingly, Poston et al. [53] indicated that motivation may be a decisive factor in whether a lifestyle intervention can improve healthy behaviours in women with obesity [53] and potentially this also holds true for women of all BMI categories. Together with the fact that participation itself could have increased participants' motivation, it is possible that the provision of additional information to the CG in the GeliS trial could have resulted in an unintentional improvement in maternal lifestyle. In order to prevent the risk of an unintentional influence on the CG in future antenatal trials as far as possible, it might be advisable to choose incentives for the CG that are not connected to lifestyle or weight gain.

5.3.4 Women's health literacy

According to Sørensen et al. [177], health literacy comprises "[…] people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgements and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course" [177] (p 3). Especially during pregnancy, adequate health literacy levels in women are needed to enable a healthy lifestyle in this challenging time period [178]. Despite the fact that the health literacy level may be connected to both maternal and child health during pregnancy [179,180], interventions to improve health literacy in pregnant women are scarce and did not investigate the effect of the intervention on health literacy [181].

In the GeliS trial, health literacy and especially health knowledge were not measured before the intervention and therefore the level of health literacy of the participants is unknown. However, this information might have been an important aspect in the discussion of why the GeliS trial failed to reduce the proportion of women with excessive GWG [131] and had only modest effects on maternal lifestyle [50,132]. Nawabi et al. [180] concluded in their systematic review on health literacy in pregnant women that in the majority of studies conducted in Western high-income countries, women have adequate health literacy levels. Similarly, the GeMuKi trial, which was conducted in South-West Germany, reported that 66.5% of the recruited pregnant women had adequate health literacy [178]. The GeliS trial was also conducted in southern Germany, therefore it is possible that the women included in the trial similarly exhibited a good level of health literacy. Since health literacy has been shown to be associated with health beliefs and attitudes as well as knowledge and lifestyle [180], the information given to the pregnant women in the GeliS study might have been too basic. The intervention was based on general recommendations and the participating women (especially those with a high health literacy) might already have had prior knowledge on the information regarding a healthy diet and PA during pregnancy. Furthermore, it could also be that the level of health literacy varied among the study population of the GeliS trial and the information provided in the lifestyle counselling sessions could have been too basic or too advanced depending on the health literacy level of the individuals. If this was the case, the lifestyle counselling content would only have served as a reminder or the understanding and ability to implement the counselling content may have been restricted (depending on the level of health literacy), both of which might have led to the limited effectiveness of the GeliS lifestyle intervention. This is in line with the results from the GeMuKi trial, which concluded that the needs of women with low health literacy might not have been met by their intervention since no health literacy level specific intervention was provided [178]. Furthermore, this might imply that inadequate health behaviours in women of childbearing age with a high level of health literacy might not be due to a lack of information or knowledge but rather due to a lack of

motivation for the implementation. In contrast, in women with a low level of health literacy, the underlying problem might be connected to the limited ability to find and understand information. Therefore, there is probably no way to establish a “one-size fits all” most effective kind of intervention regarding the improvement of health behaviours in women of childbearing age or pregnant women. For future trials, it might instead be worth considering the health literacy level of the participants to develop tailored interventions which specifically meet the needs of the study population. Furthermore, especially women with low health literacy levels might benefit the most from lifestyle counselling and might be the important target group.

6 Conclusion

The GeliS lifestyle intervention trial, which was conducted alongside the German routine antenatal care system in women with normal weight, overweight and obesity, provided women with information on a healthy lifestyle, gestational weight gain, the importance of weight monitoring and breastfeeding and on infant feeding principles. The GeliS intervention had long-term effects on the participants' dietary and smoking behaviours and thereby successfully improved maternal health behaviour in the first year postpartum [135]. Unfortunately, despite improvements in maternal lifestyle during pregnancy [50,132] and the lasting effects beyond the intervention phase [135], there was no evidence of an effect of the GeliS lifestyle intervention on child anthropometrics [133,136] and neurodevelopment [136] up to the age of 3 years. Further research is required to elucidate strategies that comprehensively improve maternal short- and long-term health behaviour as well as child development and obesity risk. Such strategies are direly needed in the light of the high prevalence of overweight and obesity and the associated consequences. To achieve a higher effectiveness of the interventions, future trials should, amongst other things, consider starting the intervention during the preconception period and continuing during pregnancy and, if applicable, carefully select the CG and avoid incentives for participation that are connected to the intended outcome. Furthermore, lifestyle counselling, delivered by lifestyle experts and/or telehealth delivery modalities, which also includes frequent contact, motivational interviewing techniques and self-monitoring strategies seems to be promising. And last but not least, measuring health literacy in the participants and tailoring interventions to the needs of the study population or specifically targeting women with low health literacy who might benefit the most from additional support might be a way forward.

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Appendix

A1 Food frequency questionnaire applied for the maternal dietary assessment in the GeliS trial.

GeliS Gesund leben in der Schwangerschaft

Teilnehmer ID – | Praxis ID –

Fragebogen zur Ernährung

- Sie werden gefragt, **wie oft** und **in welcher Menge** Sie in den letzten vier Wochen verschiedene Lebensmittel gegessen haben. Denken Sie dabei auch an Mahlzeiten, die Sie außer Haus (z. B. im Restaurant, in der Kantine) eingenommen haben.
- Bitte beantworten Sie **jede** Frage. Wenn Sie sich nicht sicher sind, dann schätzen Sie. Eine ungefähre Schätzung ist besser als gar keine Antwort.
- Denken Sie bitte nur an Ihre Ernährung **in den letzten vier Wochen!**
- Es kommt vielleicht vor, dass Sie bestimmte Sachen nicht essen oder trinken. Kreuzen Sie dann bitte **»nie«** an und gehen weiter zur nächsten Frage.
- Bei den Mengenangaben geht es um die **durchschnittliche** Menge.
- Bitte bei jeder Frage nur **eine Antwort** ankreuzen.

Beispiel:
Sie essen morgens 1 Vollkornbrötchen und abends 3 Scheiben Vollkornbrot. Bitte kreuzen Sie dann wie unten »2 Mal am Tag« und als Menge »2 Scheiben« (den Durchschnitt) an:

18	Wie oft haben Sie **Vollkornbrot oder Vollkornbrötchen** gegessen?		18a	Wenn Sie **Vollkornbrot oder Vollkornbrötchen** essen, wie viel essen Sie davon meistens?
	☐ **Nie → Bitte weiter mit Frage 19**			☐ ½ Scheibe oder ½ Brötchen (oder weniger)
	☐ 1 Mal im Monat	☐ 1 Mal am Tag		☐ 1 Scheibe oder 1 Brötchen
	☐ 2–3 Mal im Monat	☒ 2 Mal am Tag		☒ 2 Scheiben oder 2 Brötchen
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag		☐ 3 Scheiben oder 3 Brötchen
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag		☐ 4 Scheiben (oder mehr)
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

12 **Fragebogen zur Ernährung 3**

Gesund leben in der Schwangerschaft GeliS

1 Wie oft haben Sie **Milch** (einschließlich Milch für Kaffee, Müsli) getrunken?

- ☐ **Nie → Bitte weiter mit Frage 2**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

1a Wenn Sie **Milch** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Glas (oder weniger)
- ☐ 1 Glas (200 ml)
- ☐ 2 Gläser
- ☐ 3 Gläser
- ☐ 4 Gläser (oder mehr)

1b Welche Art von **Milch** trinken Sie meistens?

- ☐ Vollmilch (mindestens 3,5 % Fett)
- ☐ Fettarme Milch (1,5 % Fett)
- ☐ Magermilch (max. 0,3 % Fett)
- ☐ Sojamilch
- ☐ Laktosefreie Milch
- ☐ Andere

2 Wie oft haben Sie **zuckerhaltige Erfrischungsgetränke** (z. B. Cola, Limonade, Eistee, Malzbier) getrunken? Nicht gemeint sind Light-Getränke.

- ☐ **Nie → Bitte weiter mit Frage 3**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

2a Wenn Sie **zuckerhaltige Erfrischungsgetränke** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Glas (oder weniger)
- ☐ 1 Glas (200 ml)
- ☐ 2 Gläser
- ☐ 3 Gläser
- ☐ 4 Gläser (oder mehr)

3 Wie oft haben Sie **Energydrinks** getrunken?

- ☐ **Nie → Bitte weiter mit Frage 4**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

3a Wenn Sie **Energydrinks** trinken, wie viel trinken Sie davon meistens?

- ☐ 1/2 Dose (oder weniger)
- ☐ 1 Dose (250 ml)
- ☐ 2 Dosen
- ☐ 3 Dosen
- ☐ 4 Dosen (oder mehr)

GeliS Gesund leben in der Schwangerschaft

4 Wie oft haben Sie **kalorienreduzierte Erfrischungsgetränke** (z. B. Light-Getränke) getrunken?

- ☐ **Nie → Bitte weiter mit Frage 5**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

4a Wenn Sie **kalorienreduzierte Erfrischungsgetränke** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Glas (oder weniger)
- ☐ 1 Glas (200 ml)
- ☐ 2 Gläser
- ☐ 3 Gläser
- ☐ 4 Gläser (oder mehr)

5 Wie oft haben Sie **Fruchtsaft** (z. B. Orangen-, Apfel-, Kirschsaft) **getrunken?** Gemeint ist auch verdünnter Fruchtsaft.

- ☐ **Nie → Bitte weiter mit Frage 6**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

5a Wenn Sie **Fruchtsaft** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Glas (oder weniger)
- ☐ 1 Glas (200 ml)
- ☐ 2 Gläser
- ☐ 3 Gläser
- ☐ 4 Gläser (oder mehr)

5b Wie trinken Sie Ihren **Fruchtsaft** meistens?

- ☐ Unverdünnt
- ☐ Etwa ¼ Saft und ¾ Wasser
- ☐ Etwa ½ Saft und ½ Wasser
- ☐ Etwa ¾ Saft und ¼ Wasser

6 Wie oft haben Sie **Gemüsesaft** (z. B. Tomaten-, Karottensaft) **getrunken?** Gemeint ist auch verdünnter Gemüsesaft.

- ☐ **Nie → Bitte weiter mit Frage 7**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

6a Wenn Sie **Gemüsesaft** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Glas (oder weniger)
- ☐ 1 Glas (200 ml)
- ☐ 2 Gläser
- ☐ 3 Gläser
- ☐ 4 Gläser (oder mehr)

6b Wie trinken Sie Ihren **Gemüsesaft** meistens?

- ☐ Unverdünnt
- ☐ Etwa ¼ Saft und ¾ Wasser
- ☐ Etwa ½ Saft und ½ Wasser
- ☐ Etwa ¾ Saft und ¼ Wasser

Gesund leben in der Schwangerschaft GeliS

7 Wie oft haben Sie **Wasser** (Leitungswasser, Mineralwasser, aromatisiertes Wasser) getrunken?

- ☐ **Nie → Bitte weiter mit Frage 8**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

7a Wenn Sie **Wasser** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Glas (oder weniger)
- ☐ 1 Glas (200 ml)
- ☐ 2 Gläser
- ☐ 3 Gläser
- ☐ 4 Gläser (oder mehr)

8 Wie oft haben Sie **Früchte- oder Kräutertee** getrunken?

- ☐ **Nie → Bitte weiter mit Frage 9**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

8a Wenn Sie **Früchte- oder Kräutertee** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Tasse (oder weniger)
- ☐ 1 Tasse (150 ml)
- ☐ 2 Tassen
- ☐ 3 Tassen
- ☐ 4 Tassen (oder mehr)

8b Nehmen Sie üblicherweise **Zucker** in Ihren Früchte- oder Kräuertee? Nicht gemeint sind Süßstoffe.

- ☐ Nein
- ☐ Ja, etwa 1 Teelöffel pro Tasse
- ☐ Ja, 2 Teelöffel pro Tasse
- ☐ Ja, 3 Teelöffel (oder mehr) pro Tasse

9 Wie oft haben Sie **schwarzen oder grünen Tee** getrunken?

- ☐ **Nie → Bitte weiter mit Frage 10**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

9a Wenn Sie **schwarzen oder grünen Tee** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Tasse (oder weniger)
- ☐ 1 Tasse (150 ml)
- ☐ 2 Tassen
- ☐ 3 Tassen
- ☐ 4 Tassen (oder mehr)

9b Nehmen Sie üblicherweise **Zucker** in Ihren schwarzen oder grünen Tee? Nicht gemeint sind Süßstoffe.

- ☐ Nein
- ☐ Ja, etwa 1 Teelöffel pro Tasse
- ☐ Ja, 2 Teelöffel pro Tasse
- ☐ Ja, 3 Teelöffel (oder mehr) pro Tasse

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10 Wie oft haben Sie **Kaffee** (auch Cappuccino, Latte Macchiato, Espresso) getrunken?

- ☐ **Nie → Bitte weiter mit Frage 11**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

10a Wenn Sie **Kaffee** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Tasse (oder weniger)
- ☐ 1 Tasse (150 ml)
- ☐ 2 Tassen
- ☐ 3 Tassen
- ☐ 4 Tassen (oder mehr)

10b Nehmen Sie üblicherweise **Zucker** in Ihren Kaffee? Nicht gemeint sind Süßstoffe.

- ☐ Nein
- ☐ Ja, etwa 1 Teelöffel pro Tasse
- ☐ Ja, 2 Teelöffel pro Tasse
- ☐ Ja, 3 Teelöffel (oder mehr) pro Tasse

10c Trinken Sie in der Regel Kaffee **mit** oder **ohne Koffein?**

- ☐ mit Koffein
- ☐ ohne Koffein

11 Wie oft haben Sie **Bier** (alkoholhaltig) getrunken?

- ☐ **Nie → Bitte weiter mit Frage 12**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

11a Wenn Sie **Bier** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Flasche (oder weniger)
- ☐ 1 Flasche (330 ml)
- ☐ 2 Flaschen
- ☐ 3 Flaschen
- ☐ 4 Flaschen (oder mehr)

12 Wie oft haben Sie **alkoholfreies Bier** getrunken?

- ☐ **Nie → Bitte weiter mit Frage 13**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

12a Wenn Sie **alkoholfreies Bier** trinken, wie viel trinken Sie davon meistens?

- ☐ ½ Flasche (oder weniger)
- ☐ 1 Flasche (330 ml)
- ☐ 2 Flaschen
- ☐ 3 Flaschen
- ☐ 4 Flaschen (oder mehr)

Gesund leben in der Schwangerschaft GeliS

13	Wie oft haben Sie **Wein, Sekt oder Obstwein** getrunken?		13a	Wenn Sie **Wein, Sekt oder Obstwein** trinken, wie viel trinken Sie davon meistens?
☐	**Nie → Bitte weiter mit Frage 14**		☐	1 Glas (125 ml oder weniger)
☐	1 Mal im Monat	☐ 1 Mal am Tag	☐	2 Gläser
☐	2–3 Mal im Monat	☐ 2 Mal am Tag	☐	3 Gläser
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag	☐	4 Gläser
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag	☐	5 Gläser (oder mehr)
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

14	Wie oft haben Sie **Cocktails oder andere alkoholische Mischgetränke** getrunken?		14a	Wenn Sie **Cocktails oder andere alkoholische Mischgetränke** trinken, wie viel trinken Sie davon meistens?
☐	**Nie → Bitte weiter mit Frage 15**		☐	½ Getränk (oder weniger)
☐	1 Mal im Monat	☐ 1 Mal am Tag	☐	1 Getränk
☐	2–3 Mal im Monat	☐ 2 Mal am Tag	☐	2 Getränke
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag	☐	3 Getränke
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag	☐	4 Getränke (oder mehr)
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

15	Wie oft haben Sie **hochprozentige alkoholische Getränke** (z. B. Rum, Weinbrand, Likör, klare Schnäpse) getrunken?		15a	Wenn Sie **hochprozentige alkoholische Getränke** trinken, wie viel trinken Sie davon meistens?
☐	**Nie → Bitte weiter mit Frage 16**		☐	½ Glas (oder weniger)
☐	1 Mal im Monat	☐ 1 Mal am Tag	☐	1 Glas (2 cl)
☐	2–3 Mal im Monat	☐ 2 Mal am Tag	☐	2 Gläser
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag	☐	3 Gläser
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag	☐	4 Gläser (oder mehr)
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

16	Wie oft haben Sie **Cornflakes** (auch z. B. Choco Pops, Nougat Bits, Fruit Rings) gegessen?		16a	Wenn Sie **Cornflakes** essen, wie viel essen Sie davon meistens? Mengenangabe bitte ohne Milch.
☐	**Nie → Bitte weiter mit Frage 17**		☐	¼ Schale (oder weniger)
☐	1 Mal im Monat	☐ 1 Mal am Tag	☐	½ Schale
☐	2–3 Mal im Monat	☐ 2 Mal am Tag	☐	1 Schale
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag	☐	2 Schalen
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag	☐	3 Schalen (oder mehr)
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		Gemeint ist eine Dessertschale von 150 ml.

GeliS Gesund leben in der Schwangerschaft

17 Wie oft haben Sie **Müsli** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 18**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

17a Wenn Sie **Müsli** essen, wie viel essen Sie davon meistens? Mengenangabe bitte ohne Milch.

- ☐ ¼ Schale (oder weniger)
- ☐ ½ Schale
- ☐ 1 Schale
- ☐ 2 Schalen
- ☐ 3 Schalen (oder mehr)

Gemeint ist eine Dessertschale von 150 ml.

18 Wie oft haben Sie **Vollkornbrot oder Vollkornbrötchen** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 19**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

18a Wenn Sie **Vollkornbrot oder Vollkornbrötchen** essen, wie viel essen Sie davon meistens?

- ☐ ½ Scheibe oder ½ Brötchen (oder weniger)
- ☐ 1 Scheibe oder 1 Brötchen
- ☐ 2 Scheiben oder 2 Brötchen
- ☐ 3 Scheiben oder 3 Brötchen
- ☐ 4 Scheiben (oder mehr)

19 Wie oft haben Sie **Graubrot oder Mischbrot** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 20**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

19a Wenn Sie **Graubrot oder Mischbrot** essen, wie viel essen Sie davon meistens?

- ☐ ½ Scheibe oder ½ Brötchen (oder weniger)
- ☐ 1 Scheibe oder 1 Brötchen
- ☐ 2 Scheiben oder 2 Brötchen
- ☐ 3 Scheiben oder 3 Brötchen
- ☐ 4 Scheiben (oder mehr)

20 Wie oft haben Sie **Weißbrot oder Brötchen** (auch Laugenbrötchen, Fladenbrot) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 21**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

20a Wenn Sie **Weißbrot oder Brötchen** essen, wie viel essen Sie davon meistens?

- ☐ ½ Scheibe oder ½ Brötchen (oder weniger)
- ☐ 1 Scheibe oder 1 Brötchen
- ☐ 2 Scheiben oder 2 Brötchen
- ☐ 3 Scheiben oder 3 Brötchen
- ☐ 4 Scheiben (oder mehr)

Gesund leben in der Schwangerschaft GeliS

21 Wie oft haben Sie **Butter oder Margarine** (auf Brot etc.) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 22**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

21a Wenn Sie **Butter oder Margarine** essen, wie viel essen Sie davon meistens?

- ☐ ½ Teelöffel (oder weniger)
- ☐ 1 Teelöffel (gestrichen)
- ☐ 2 Teelöffel (gestrichen)
- ☐ 3 Teelöffel (gestrichen)
- ☐ 4 Teelöffel (oder mehr)

22 Wie oft haben Sie **Frischkäse** (z. B. Philadelphia, Hüttenkäse) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 23**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

22a Wenn Sie **Frischkäse** essen, wie viel essen Sie davon meistens?

- ☐ ½ Esslöffel (oder weniger)
- ☐ 1 Esslöffel (gestrichen)
- ☐ 2 Esslöffel (gestrichen)
- ☐ 3 Esslöffel (gestrichen)
- ☐ 4 Esslöffel (oder mehr)

22b Essen Sie **fettarmen Frischkäse?**

- ☐ Selten oder nie
- ☐ Etwa zur Hälfte
- ☐ Überwiegend
- ☐ Weiß ich nicht

23 Wie oft haben Sie **Käse** (Weich-, Schnitt- oder Hartkäse) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 24**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

23a Wenn Sie **Käse** essen, wie viel essen Sie davon meistens?

- ☐ ½ Scheibe oder ½ Portion (oder weniger)
- ☐ 1 Scheibe oder 1 Portion
- ☐ 2 Scheiben oder 2 Portionen
- ☐ 3 Scheiben oder 3 Portionen
- ☐ 4 Scheiben oder 4 Portionen (oder mehr)

1 Scheibe oder 1 Portion sind ca. 30 g.

23b Essen Sie **fettarmen Käse?**

- ☐ Selten oder nie
- ☐ Etwa zur Hälfte
- ☐ Überwiegend
- ☐ Weiß ich nicht

GeliS Gesund leben in der Schwangerschaft

24 Wie oft haben Sie **Quark, Joghurt oder Dickmilch** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 25**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

24a Wenn Sie **Quark, Joghurt oder Dickmilch** essen, wie viel essen Sie davon meistens?

- ☐ ½ Becher (oder weniger)
- ☐ 1 Becher (200 g)
- ☐ 2 Becher
- ☐ 3 Becher
- ☐ 4 Becher

24b Essen Sie **fettarmen Quark, Joghurt oder fettarme Dickmilch?**

- ☐ Selten oder nie
- ☐ Etwa zur Hälfte
- ☐ Überwiegend
- ☐ Weiß ich nicht

25 Wie oft haben Sie **Honig oder Marmelade** (auch Sirup) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 26**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

25a Wenn Sie **Honig oder Marmelade** essen, wie viel essen Sie davon meistens?

- ☐ 1 Teelöffel (oder weniger)
- ☐ 2 Teelöffel (gehäuft)
- ☐ 3 Teelöffel (gehäuft)
- ☐ 4 Teelöffel (gehäuft)
- ☐ 5 Teelöffel (oder mehr)

26 Wie oft haben Sie **Nuss-Nougatcreme** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 27**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

26a Wenn Sie **Nuss-Nougatcreme** essen, wie viel essen Sie davon meistens?

- ☐ 1 Teelöffel (oder weniger)
- ☐ 2 Teelöffel (gehäuft)
- ☐ 3 Teelöffel (gehäuft)
- ☐ 4 Teelöffel (gehäuft)
- ☐ 5 Teelöffel (oder mehr)

Gesund leben in der Schwangerschaft GeliS

27 Wie oft haben Sie **Eier** (z. B. Spiegelei, Rührei, gekochtes Ei) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 28**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

27a Wenn Sie **Eier** essen, wie viel essen Sie davon meistens?

- ☐ ½ Ei (oder weniger)
- ☐ 1 Ei
- ☐ 2 Eier
- ☐ 3 Eier
- ☐ 4 Eier (oder mehr)

28 Wie oft haben Sie **Geflügel** (z. B. Hähnchen, Chicken Nuggets) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 29**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

28a Wenn Sie **Geflügel** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Portion (oder weniger)
- ☐ ½ Portion
- ☐ 1 Portion
- ☐ 2 Portionen
- ☐ 3 Portionen (oder mehr)

Mit einer Portion sind etwa 1 Hähnchenschenkel oder 8 Nuggets gemeint.

28b Wie oft war das **Geflügel** paniert oder frittiert (z. B. Nuggets)?

- ☐ (Fast) nie
- ☐ Etwa ¼ des Verzehrs
- ☐ Etwa ½ des Verzehrs
- ☐ Etwa ¾ des Verzehrs
- ☐ (Fast) immer

29 Wie oft haben Sie **Hamburger oder Döner Kebab** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 30**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

29a Wenn Sie **Hamburger oder Döner Kebab** essen, wie viel essen Sie davon meistens?

- ☐ ½ Stück (oder weniger)
- ☐ 1 Stück
- ☐ 2 Stück
- ☐ 3 Stück
- ☐ 4 Stück (oder mehr)

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30 Wie oft haben Sie **Bratwurst oder Currywurst** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 31**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

30a Wenn Sie **Bratwurst oder Currywurst** essen, wie viel essen Sie davon meistens?

- ☐ ½ Stück (oder weniger)
- ☐ 1 Stück
- ☐ 2 Stück
- ☐ 3 Stück
- ☐ 4 Stück (oder mehr)

31 Wie oft haben Sie **Fleisch** (z. B. Schweinefleisch, Rindfleisch, Wildfleisch) gegessen? Nicht gemeint sind Wurst oder Geflügel.

- ☐ **Nie → Bitte weiter mit Frage 32**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

31a Wenn Sie **Fleisch** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Portion (oder weniger)
- ☐ ½ Portion
- ☐ 1 Portion
- ☐ 2 Portionen
- ☐ 3 Portionen (oder mehr)

Mit einer Portion ist etwa 1 Kotelett, 1 Steak oder 1 Schnitzel gemeint.

31b Wie oft war das **Fleisch** paniert (z. B. Wiener Schnitzel)?

- ☐ (Fast) nie
- ☐ Etwa ¼ des Verzehrs
- ☐ Etwa ½ des Verzehrs
- ☐ Etwa ¾ des Verzehrs
- ☐ (Fast) immer

32 Wie oft haben Sie **Wurst** (z. B. Salami, Leberwurst) gegessen? Nicht gemeint ist Schinken.

- ☐ **Nie → Bitte weiter mit Frage 33**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

32a Wenn Sie **Wurst** essen, wie viel essen Sie davon meistens?

- ☐ ½ Scheibe
- ☐ 1 Scheibe
- ☐ 2 Scheiben
- ☐ 3 Scheiben
- ☐ 4 Scheiben (oder mehr)

32b Essen Sie **fettarme Wurst?**

- ☐ Selten oder nie
- ☐ Etwa zur Hälfte
- ☐ Überwiegend
- ☐ Weiß ich nicht

Gesund leben in der Schwangerschaft GeliS

33	Wie oft haben Sie **Schinken** gegessen?	
☐	**Nie → Bitte weiter mit Frage 34**	
☐	1 Mal im Monat	☐ 1 Mal am Tag
☐	2–3 Mal im Monat	☐ 2 Mal am Tag
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

33a	Wenn Sie **Schinken** essen, wie viel essen Sie davon meistens?
☐	½ Scheibe
☐	1 Scheibe
☐	2 Scheiben
☐	3 Scheiben
☐	4 Scheiben (oder mehr)

34	Wie oft haben Sie **kalten Fisch** (z. B. Räucherlachs, Matjes, Thunfisch) gegessen?	
☐	**Nie → Bitte weiter mit Frage 35**	
☐	1 Mal im Monat	☐ 1 Mal am Tag
☐	2–3 Mal im Monat	☐ 2 Mal am Tag
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

34a	Wenn Sie **kalten Fisch** essen, wie viel essen Sie davon meistens?
☐	¼ Portion (oder weniger)
☐	½ Portion
☐	1 Portion
☐	2 Portionen
☐	3 Portionen (oder mehr)
	Mit einer Portion ist etwa die Menge eines Brotbelages gemeint.

35	Wie oft haben Sie **Fisch als warme Mahlzeit** (z. B. Seelachs, Forelle) gegessen?	
☐	**Nie → Bitte weiter mit Frage 36**	
☐	1 Mal im Monat	☐ 1 Mal am Tag
☐	2–3 Mal im Monat	☐ 2 Mal am Tag
☐	1–2 Mal pro Woche	☐ 3 Mal am Tag
☐	3–4 Mal pro Woche	☐ 4–5 Mal am Tag
☐	5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

35a	Wenn Sie **Fisch als warme Mahlzeit** essen, wie viel essen Sie davon meistens?
☐	¼ Portion (oder weniger)
☐	½ Portion
☐	1 Portion
☐	2 Portionen
☐	3 Portionen (oder mehr)
	Mit einer Portion sind 1 Fischfilet oder 4 Fischstäbchen gemeint.

35b	Wie oft war der **Fisch** paniert oder frittiert?
☐	(Fast) nie
☐	Etwa ¼ des Verzehrs
☐	Etwa ½ des Verzehrs
☐	Etwa ¾ des Verzehrs
☐	(Fast) immer

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36	Wie oft haben Sie **frisches Obst** (z. B. Apfel, Banane) gegessen?	
	☐ **Nie → Bitte weiter mit Frage 37**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

36a	Wenn Sie **frisches Obst** essen, wie viel essen Sie davon meistens?
	☐ ½ Stück oder ½ Schale (oder weniger)
	☐ 1 Stück oder 1 Schale
	☐ 2 Stück oder 2 Schalen
	☐ 3 Stück oder 3 Schalen
	☐ 4 Stück oder 4 Schalen (oder mehr)
	1 Stück ist z. B. 1 Apfel oder 1 Banane. Mit Schale ist eine kleine Dessertschale von 150 ml mit z. B. Erdbeeren oder Kirschen gemeint.

37	Wie oft haben Sie **gegartes Obst** (z. B. Kompott, Konservenobst) gegessen?	
	☐ **Nie → Bitte weiter mit Frage 38**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

37a	Wenn Sie **gegartes Obst** essen, wie viel essen Sie davon meistens?
	☐ ¼ Schale (oder weniger)
	☐ ½ Schale
	☐ 1 Schale
	☐ 2 Schalen
	☐ 3 Schalen (oder mehr)
	Gemeint ist eine Dessertschale von 150 ml.

38	Wie oft haben Sie **rohes Gemüse** (z. B. Kopfsalat, Rohkost) gegessen?	
	☐ **Nie → Bitte weiter mit Frage 39**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

38a	Wenn Sie **rohes Gemüse** essen, wie viel essen Sie davon meistens?
	☐ ¼ Portion (oder weniger)
	☐ ½ Portion
	☐ 1 Portion
	☐ 2 Portionen
	☐ 3 Portionen (oder mehr)
	Gemeint ist eine Beilagenportion von etwa 150 g.

39	Wie oft haben Sie **Hülsenfrüchte** (z. B. Bohnen, Erbsen, Linsen) gegessen?	
	☐ **Nie → Bitte weiter mit Frage 40**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

39a	Wenn Sie **Hülsenfrüchte** essen, wie viel essen Sie davon meistens?
	☐ ¼ Portion (oder weniger)
	☐ ½ Portion
	☐ 1 Portion
	☐ 2 Portionen
	☐ 3 Portionen (oder mehr)
	Gemeint ist eine Beilagenportion von etwa 150 g.

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40 Wie oft haben Sie **gegartes Gemüse** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 41**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

40a Wenn Sie **gegartes Gemüse** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Portion (oder weniger)
- ☐ ½ Portion
- ☐ 1 Portion
- ☐ 2 Portionen
- ☐ 3 Portionen (oder mehr)

Gemeint ist eine Beilagenportion von etwa 150 g.

40b Wenn **Sie gegartes Gemüse** essen, dann ist das üblicherweise:

- ☐ Frisch (roh) eingekauft
- ☐ Tiefkühlgemüse
- ☐ Konservengemüse
- ☐ Weiß ich nicht

41 Wie oft haben Sie **Nudeln** (z. B. Spaghetti, Spätzle, Ravioli, Lasagne) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 42**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

41a Wenn Sie **Nudeln** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Teller (oder weniger)
- ☐ ½ Teller
- ☐ 1 Teller
- ☐ 2 Teller
- ☐ 3 Teller (oder mehr)

42 Wie oft haben Sie **Reis** (auch Couscous, Bulgur) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 43**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

42a Wenn Sie **Reis** (auch Couscous, Bulgur) essen, wie viel essen Sie davon meistens?

- ☐ ¼ Portion (oder weniger)
- ☐ ½ Portion
- ☐ 1 Portion
- ☐ 2 Portionen
- ☐ 3 Portionen (oder mehr)

Gemeint ist eine Beilagenportion von etwa 150 g.

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43 Wie oft haben Sie **gekochte Kartoffeln** (z. B. Salzkartoffeln, Pellkartoffeln, Kartoffelklöße) gegessen?

- ☐ **Nie → Bitte weiter mit Frage 44**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

43a Wenn Sie **gekochte Kartoffeln** essen, wie viel essen Sie davon meistens?

- ☐ ½ Portion oder 1 Kartoffel (oder weniger)
- ☐ 1 Portion oder 2 Kartoffeln
- ☐ 1 ½ Portionen oder 3 Kartoffeln
- ☐ 2 Portionen oder 4 Kartoffeln
- ☐ 2 ½ Portionen oder 5 Kartoffeln (oder mehr)

Gemeint sind mittelgroße Kartoffeln.

44 Wie oft haben Sie **gebratene Kartoffeln** (auch Kroketten oder Kartoffelpuffer) gegessen? Nicht gemeint sind Pommes.

- ☐ **Nie → Bitte weiter mit Frage 45**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

44a Wenn Sie **gebratene Kartoffeln** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Teller (oder weniger)
- ☐ ½ Teller
- ☐ 1 Teller
- ☐ 2 Teller
- ☐ 3 Teller (oder mehr)

45 Wie oft haben Sie **Pommes Frites** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 46**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

45a Wenn Sie **Pommes Frites** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Portion (oder weniger)
- ☐ ½ Portion
- ☐ 1 Portion
- ☐ 2 Portionen
- ☐ 3 Portionen (oder mehr)

Gemeint ist eine mittlere Portion am Imbissstand.

46 Wie oft haben Sie **Pizza** gegessen?

- ☐ **Nie → Bitte weiter mit Frage 47**
- ☐ 1 Mal im Monat
- ☐ 2–3 Mal im Monat
- ☐ 1–2 Mal pro Woche
- ☐ 3–4 Mal pro Woche
- ☐ 5–6 Mal pro Woche
- ☐ 1 Mal am Tag
- ☐ 2 Mal am Tag
- ☐ 3 Mal am Tag
- ☐ 4–5 Mal am Tag
- ☐ Öfter als 5 Mal am Tag

46a Wenn Sie **Pizza** essen, wie viel essen Sie davon meistens?

- ☐ ¼ Portion (oder weniger)
- ☐ ½ Portion
- ☐ 1 Portion
- ☐ 2 Portionen
- ☐ 3 Portionen (oder mehr)

Mit einer Portion ist eine Tiefkühlpizza von etwa 350 g gemeint.

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47	Wie oft haben Sie **Kuchen, Torten oder süße Backwaren** (auch Muffins, Apfeltaschen, Baklava) gegessen?		47a	Wenn Sie **Kuchen, Torten oder süße Backwaren** essen, wie viel essen Sie davon meistens?
	☐ **Nie → Bitte weiter mit Frage 48**			☐ ½ Stück (oder weniger)
	☐ 1 Mal im Monat	☐ 1 Mal am Tag		☐ 1 Stück
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag		☐ 2 Stück
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag		☐ 3 Stück
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag		☐ 4 Stück (oder mehr)
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

48	Wie oft haben Sie **Kekse** (z. B. Butterkekse, Plätzchen) gegessen?		48a	Wenn Sie **Kekse** essen, wie viel essen Sie davon meistens?
	☐ **Nie → Bitte weiter mit Frage 49**			☐ 2 Kekse (oder weniger)
	☐ 1 Mal im Monat	☐ 1 Mal am Tag		☐ 3 Kekse
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag		☐ 4 Kekse
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag		☐ 5 Kekse
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag		☐ 6 Kekse (oder mehr)
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

49	Wie oft haben Sie **Schokolade oder Schokoriegel** (auch Pralinen) gegessen?		49a	Wenn Sie **Schokolade oder Schokoriegel** essen, wie viel essen Sie davon meistens?
	☐ **Nie → Bitte weiter mit Frage 50**			☐ ½ kleinen Schokoriegel (oder weniger)
	☐ 1 Mal im Monat	☐ 1 Mal am Tag		☐ ¼ Tafel oder 1 kleinen Schokoriegel
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag		☐ ½ Tafel oder 1 großen Schokoriegel
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag		☐ 1 Tafel oder 2 große Schokoriegel
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag		☐ 2 Tafeln (oder mehr)
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		Gemeint ist eine Tafel von 100 g.

50	Wie oft haben Sie **Süßigkeiten** (z. B. Bonbons, Fruchtgummi, Hustenbonbons, Lakritz) gegessen?		50a	Wenn Sie **Süßigkeiten** essen, wie viel essen Sie davon meistens?
	☐ **Nie → Bitte weiter mit Frage 51**			☐ 1 Stück
	☐ 1 Mal im Monat	☐ 1 Mal am Tag		☐ 2–5 Stück
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag		☐ 6–10 Stück
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag		☐ 11–20 Stück
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag		☐ 21 Stück (oder mehr)
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag		

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51	Wie oft haben Sie **Eis** gegessen?	
	☐ **Nie → Bitte weiter mit Frage 52**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

51a	Wenn Sie **Eis** essen, wie viel essen Sie davon meistens?
	☐ ½ Kugel (oder weniger)
	☐ 1 Kugel
	☐ 2 Kugeln oder 1 Eis am Stiel
	☐ 3 Kugeln
	☐ 4 Kugeln (oder mehr)

52	Wie oft haben Sie **Kartoffelchips** gegessen?	
	☐ **Nie → Bitte weiter mit Frage 53**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

52a	Wenn Sie **Kartoffelchips** essen, wie viel essen Sie davon meistens?
	☐ ¼ Schale (oder weniger)
	☐ ½ Schale
	☐ 1 Schale
	☐ 2 Schalen
	☐ 3 Schalen (oder mehr)
	Gemeint ist eine Dessertschale von 150 ml.

53	Wie oft haben Sie **Salzgebäck oder Cracker** (z. B. Salzstangen) gegessen?	
	☐ **Nie → Bitte weiter mit Frage 54**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

53a	Wenn Sie **Salzgebäck oder Cracker** essen, wie viel essen Sie davon meistens?
	☐ ¼ Schale (oder weniger)
	☐ ½ Schale
	☐ 1 Schale
	☐ 2 Schalen
	☐ 3 Schalen (oder mehr)
	Gemeint ist eine Dessertschale von 150 ml.

54	Wie oft haben Sie **Nüsse** (z. B. Erdnüsse, Walnüsse, Haselnüsse) gegessen?	
	☐ **Nie → Bitte weiter mit Frage 55**	
	☐ 1 Mal im Monat	☐ 1 Mal am Tag
	☐ 2–3 Mal im Monat	☐ 2 Mal am Tag
	☐ 1–2 Mal pro Woche	☐ 3 Mal am Tag
	☐ 3–4 Mal pro Woche	☐ 4–5 Mal am Tag
	☐ 5–6 Mal pro Woche	☐ Öfter als 5 Mal am Tag

54a	Wenn Sie **Nüsse** essen, wie viel essen Sie davon meistens?
	☐ ¼ Portion (oder weniger)
	☐ ½ Portion
	☐ 1 Portion
	☐ 2 Portionen
	☐ 3 Portionen (oder mehr)
	Mit einer Portion ist eine Handvoll von ca. 25 g gemeint.

Gesund leben in der Schwangerschaft GeliS

55	Welches **Fett** verwenden Sie bei der Zubereitung von **Fleisch oder Fisch** hauptsächlich?
☐	Butter, Margarine
☐	Olivenöl
☐	Rapsöl
☐	Pflanzliches Kochfett (z. B. Biskin, Palmin)
☐	Tierisches Kochfett (z. B. Schmalz)
☐	Sonnenblumen-, Distel-, Keimöl etc.
☐	Weiß ich nicht
☐	Kein

56	Welches **Fett** verwenden Sie bei der Zubereitung von **Gemüse** hauptsächlich?
☐	Butter, Margarine
☐	Olivenöl
☐	Rapsöl
☐	Pflanzliches Kochfett (z. B. Biskin, Palmin)
☐	Tierisches Kochfett (z. B. Schmalz)
☐	Sonnenblumen-, Distel-, Keimöl etc.
☐	Weiß ich nicht
☐	Kein

57	Essen Sie üblicherweise **vegetarisch?**
☐	**Nein → Bitte weiter mit Frage 58**
☐	Ja

57a	Welche der folgenden Lebensmitteln essen Sie **nicht?** Mehrfachangaben möglich.
☐	Fleisch, Geflügel und Wurst
☐	Fisch
☐	Milch und Milchprodukte
☐	Eier

58	Wie häufig in der Woche bereiten Sie aus Grundzutaten/ frischen Lebensmitteln eine warme Mahlzeit (Mittag- oder Abendessen) selbst zu?
☐	Täglich
☐	5–6 Mal pro Woche
☐	3–4 Mal pro Woche
☐	1–2 Mal pro Woche
☐	Nie

59	Rauchen Sie zurzeit?
☐	Ja, regelmäßig
☐	Ja, gelegentlich (< 1 Zigarette pro Tag)
☐	Nein, nicht mehr
☐	Habe noch nie geraucht

59a	Wenn Sie rauchen, wie viele Zigaretten rauchen Sie pro Tag?
	_____ Zigaretten

Quelle: modifiziert nach Ernährungsfragebogen der Studie zur Gesundheit Erwachsener in Deutschland (DEGS) des Robert Koch Instituts, Berlin, 2008

A2 Pregnancy physical activity questionnaire applied for maternal physical activity behaviour assessment in the GeliS trial.

GeliS Gesund leben in der Schwangerschaft

Teilnehmer ID – Praxis ID –

Fragebogen zur Bewegung

- Sie werden gefragt, **wie viel Zeit** Sie in den letzten vier Wochen mit verschiedenen körperlichen Aktivitäten verbracht haben.
- Bitte beantworten Sie **jede** Frage. Wenn Sie sich nicht sicher sind, dann schätzen Sie. Eine ungefähre Schätzung ist besser als gar keine Antwort.
- Denken Sie bitte nur an Ihre Bewegung **in den letzten vier Wochen!**
- Bei den Zeitangaben geht es um **durchschnittliche Werte.**
- Bitte bei jeder Frage nur **eine Antwort** ankreuzen.

Beispiel:
Wie viel Zeit haben Sie **während der letzten 4 Wochen** durchschnittlich mit folgender Tätigkeit verbracht:

→ Wenn Sie täglich 2 Stunden lang Ihre Mutter pflegen, dann sollte Ihre Antwort folgendermaßen aussehen:

7	Ältere Erwachsene pflegen
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☒	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

6 Fragebogen zur Bewegung 3

Gesund leben in der Schwangerschaft GeliS

Zu Hause...

Wie viel Zeit haben Sie **während der letzten 4 Wochen** durchschnittlich mit folgenden Tätigkeiten verbracht:

1 Mahlzeiten vor- oder zubereiten (Kochen, Tisch decken, Geschirr spülen)

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

2 Im Sitzen Kinder ankleiden, baden oder füttern

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

3 Im Stehen Kinder ankleiden, baden oder füttern

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

4 Im Sitzen oder Stehen mit Kindern spielen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

5 Im Gehen oder Rennen mit Kindern spielen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

6 Kinder tragen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

7 Ältere Erwachsene pflegen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

8 Am Schreibtisch oder Computer sitzen, ohne in der Arbeit zu sein

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 1 Stunde pro Tag
- ☐ 1 bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 3 Stunden pro Tag
- ☐ 3 oder mehr Stunden pro Tag

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9	Fernsehen oder DVD schauen
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 4 Stunden pro Tag
☐	4 bis annähernd 6 Stunden pro Tag
☐	6 oder mehr Stunden pro Tag

10	Sitzen und lesen, reden oder telefonieren, **ohne** in der Arbeit zu sein
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 4 Stunden pro Tag
☐	4 bis annähernd 6 Stunden pro Tag
☐	6 oder mehr Stunden pro Tag

11	Mit Tieren spielen
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

12	**Leichte** Aufräum- oder Putzarbeiten erledigen (Betten machen, Wäsche waschen)
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

13	Einkaufen (Essen, Kleidung oder Sonstiges)
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

14	**Anstrengende** Putzarbeiten erledigen (Staub saugen, Fenster putzen, fegen)
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

15	Rasen mähen (kein Rasenmähertraktor), rechen oder andere Gartenarbeiten erledigen
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

Gesund leben in der Schwangerschaft GeliS

An Orte gehen...

Wie viel Zeit haben Sie **während der letzten 4 Wochen** durchschnittlich mit folgenden Tätigkeiten verbracht:

16	**Langsam** an diverse Orte gehen (z.B. zum Bus, zur Arbeit, zu Besuchen) **nicht** zum Spaß oder Sport
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

17	**Schnell** an diverse Orte gehen (z.B. zum Bus, zur Arbeit, zu Besuchen) **nicht** zum Spaß oder Sport
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

18	Mit Auto oder Bus fahren
☐	Keine
☐	Weniger als ½ Stunde pro Tag
☐	½ bis annähernd 1 Stunde pro Tag
☐	1 bis annähernd 2 Stunden pro Tag
☐	2 bis annähernd 3 Stunden pro Tag
☐	3 oder mehr Stunden pro Tag

Spaß oder Sport...

Wie viel Zeit haben Sie **während der letzten 4 Wochen** durchschnittlich mit folgenden Tätigkeiten verbracht:

19	**Langsam** gehen zum Spaß oder Sport
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

20	**Schnell** gehen zum Spaß oder Sport
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

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21	**Schnell** Berge hoch gehen, zum Spaß oder Sport
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

22	Joggen
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

23	Rückbildungskurse besuchen
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

24	Schwimmen
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

25	Tanzen
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

Andere Dinge zum Spaß oder Sport getan?
Bitte sagen Sie uns welche:

26	
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

27	
☐	Keine
☐	Weniger als ½ Stunde pro **Woche**
☐	½ bis annähernd 1 Stunde pro **Woche**
☐	1 bis annähernd 2 Stunden pro **Woche**
☐	2 bis annähernd 3 Stunden pro **Woche**
☐	3 oder mehr Stunden pro **Woche**

Gesund leben in der Schwangerschaft GeliS

Bitte füllen Sie den nächsten Abschnitt nur aus, wenn Sie erwerbstätig sind, ehrenamtlich arbeiten oder Schülerin/Studentin sind. Wenn Sie Hausfrau, arbeitslos oder arbeitsunfähig sind, bitte weiter mit dem Fragebogen zur Ernährung (Seite 12).

In der Arbeit...

Wie viel Zeit haben Sie **während der letzten 4 Wochen** durchschnittlich mit folgenden Tätigkeiten verbracht:

28 In der Arbeit/Schule/Studium sitzen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 4 Stunden pro Tag
- ☐ 4 bis annähernd 6 Stunden pro Tag
- ☐ 6 oder mehr Stunden pro Tag

29 In der Arbeit stehen oder **langsam** gehen und dabei **nichts** tragen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 4 Stunden pro Tag
- ☐ 4 bis annähernd 6 Stunden pro Tag
- ☐ 6 oder mehr Stunden pro Tag

30 In der Arbeit stehen oder **langsam** gehen und dabei Dinge **tragen** (schwerer als 4 kg = 4 Flaschen Wasser oder 4 Kartons Milch)

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 4 Stunden pro Tag
- ☐ 4 bis annähernd 6 Stunden pro Tag
- ☐ 6 oder mehr Stunden pro Tag

31 Bei der Arbeit **schnell** gehen und dabei **nichts** tragen

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 4 Stunden pro Tag
- ☐ 4 bis annähernd 6 Stunden pro Tag
- ☐ 6 oder mehr Stunden pro Tag

32 In der Arbeit **schnell** gehen und dabei Dinge **tragen** (schwerer als 4 kg = 4 Flaschen Wasser oder 4 Kartons Milch)

- ☐ Keine
- ☐ Weniger als ½ Stunde pro Tag
- ☐ ½ bis annähernd 2 Stunden pro Tag
- ☐ 2 bis annähernd 4 Stunden pro Tag
- ☐ 4 bis annähernd 6 Stunden pro Tag
- ☐ 6 oder mehr Stunden pro Tag

Quelle: modifiziert nach Chasan-Taber L, Schmidt MD, Roberts DE, Hosmer D, Markenson G, Freedson PS. Development and Validation of a Pregnancy Physical Activity Questionnaire. Med Sci Sports Exer 2004 36(10):1750-1760.

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