The Relationship of Diet and Physical Activity with Weight Gain and Weight Gain Prevention in Women of Reproductive Age

Mamaru Ayenew Awoke 1, Helen Skouteris 2, Maureen Makama 1, Cheryce L. Harrison 1, Thomas Philip Wycherley 3 and Lisa J. Moran 1,*

1 Monash Centre for Health Research and Implementation, Monash University, Clayton, VIC 3168, Australia; mamaru.awoke@monash.edu (M.A.A.); maureen.makama@monash.edu (M.M.); cheryce.harrison@monash.edu (C.L.H.)
2 Health and Social Care Unit, School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC 3004, Australia; helen.skouteris@monash.edu
3 Alliance for Research in Exercise, Nutrition and Activity, University of South Australia, Adelaide, SA 5001, Australia; Tom.Wycherley@unisa.edu.au

* Correspondence: lisa.moran@monash.edu; Tel.: +61-3-8572-2664

Abstract: Reproductive-age women often see increased weight gain, which carries an increased risk of long-term overweight and obesity and adverse maternal and child health outcomes. Supporting women to achieve optimal weight through lifestyle modification (diet and physical activity) is of critical importance to reduce weight gain across key reproductive life-stages (preconception, pregnancy and postpartum). This review comprehensively summarizes the current state of knowledge on the contribution of diet and physical activity to weight gain and weight gain prevention in reproductive-aged women. Suboptimal diets including a higher proportion of discretionary choices or energy intake from fats, added sugars, sweets or processed foods are associated with higher weight gain, whereas increased consumption of core foods including fruits, vegetables and whole grains and engaging in regular physical activity are associated with reduced weight gain in reproductive age women. Diet and physical activity contributing to excessive gestational weight gain are well documented. However, there is limited research assessing diet and physical activity components associated with weight gain during the preconception and postpartum period. This review highlights the need for further research to identify key dietary and physical activity components targeting the critical windows of reproductive life-stages in women to best guide interventions to prevent weight gain.

Keywords: diet; physical activity; preconception; pregnancy; postpartum; weight gain

1. Introduction

Overweight and obesity affect one-third of the world’s population and are associated with a range of chronic health outcomes including type 2 diabetes (DM2), hypertension, cancer, cardiovascular diseases (CVD) and mortality [1–3]. The rate of obesity continues to escalate worldwide, exacerbating many causes of premature death and imposing a substantial economic burden [2,4,5]. According to the World Health Organization, 44% of adults aged 18 or over worldwide had overweight or obesity in 2016 [6]. Of these, 39% of men and 40% of women had overweight while 11% of men and 15% of women had obesity [6]. Evidence from longitudinal data shows adults gain on average 0.5 to 0.8 kg per year [7–9]. There is now a large body of evidence from over 20 systematic reviews and meta-analyses [10–30], published since 2000, of observational and intervention studies assessing diet and physical activity (PA) components associated with weight gain. These report that increased intake of diets characterized by high energy-dense discretionary foods and beverages are associated with weight gain [11,14,17–19,21,23–25,30] and limited...
consumption of discretionary foods and beverages, higher consumption of core foods (e.g., fruit, vegetables, whole grain or dietary fiber) and higher diet quality are associated with reduced weight gain in the adult population \([10,12,13,15,16,20,22,26–29,31]\). Evidence also consistently reports that moderate-to-vigorous intensity PA \((\geq 150 \text{ min/week})\) is associated with lower weight gain \([32,33]\). Similarly, in relation to weight gain prevention, there is an abundance of evidence from several systematic reviews and meta-analyses that have synthesized the literature assessing lifestyle interventions targeting the prevention of weight gain in young adults, under 35 years of age \([34–36]\), and in the general population \([37,38]\). A recent systematic review and meta-analysis evaluated trials assessing weight gain prevention in adults and reported that lifestyle (diet and/or physical activity) interventions result in differences in weight \((\text{MD} −1.15 \text{ kg}; 95\% \text{ CI} −1.50, −0.80 \text{ kg})\) compared to controls \([39]\).

Whilst the findings above report on the general adult population, we also know that women of reproductive age are at higher risk of longitudinal weight gain and obesity \([40]\). The Australian Longitudinal Study on Women’s Health reported an average weight gain of 6.3 kg over 10 years \([41]\), with this rate of weight gain greater in women 18–50 years old compared to women aged 50 and over \([42]\). This confers an increased risk of long-term overweight and obesity. Reproductive life stages in women including preconception, pregnancy and postpartum are critical windows that drive this weight gain and maternal adiposity \([43,44]\). Nearly 50% of women enter pregnancy with overweight or obesity \([45]\) and 51% gain weight above the Institute of Medicine (IOM) recommendation \([46]\). Postpartum, women retain an average of 0.5 to 3 kg from each pregnancy \([47]\). Preconception overweight and obesity are linked to reduced fertility and delayed conception \([48]\). Overweight and obesity during preconception or pregnancy additionally increase the risk of maternal complications and adverse birth outcomes \([49,50]\). Evidence consistently shows that higher pre-pregnancy body mass index (BMI) is a strong predictor of excessive gestational and pregnancy complications \([51]\). Excessive weight gain during pregnancy is also associated with an elevated risk of gestational diabetes, gestational hypertension and preeclampsia, emergency caesarean delivery, hyperglycemia \([52,53]\) and increases the risk of congenital diseases, macrosomia, preterm birth \([54]\), stillbirth \([55]\), future risk of DM2 \([56]\) and CVD \([57]\). Excessive gestational weight gain (GWG) is a strong predictor of postpartum weight retention \([58,59]\). A meta-analysis of observational studies reported that women who gained weight above IOM recommendations during pregnancy (singleton pregnancies) retained an additional 3.1 kg and 4.7 kg after 3 and ≥15 years postpartum, respectively, compared to women who gained weight within recommendations \([59]\). Postpartum weight retention and excessive weight gain after birth are also associated with increased risk of adverse maternal \([60,61]\) and neonatal outcomes \([62]\) during subsequent pregnancies and risk of longer-term chronic maternal conditions including DM2 \([63,64]\) and CVD \([65]\). Maternal obesity has additional implications on the offspring including childhood obesity \([66,67]\) and cardiometabolic risk factors \([68]\), which may persist into adulthood \([50]\).

Treatment of established obesity through weight loss interventions is intensive, costly and challenging for participants and largely ineffective and unsustainable \([69]\) with only 20% of individuals successful at long-term weight maintenance after weight loss interventions \([70]\). Prevention of weight gain is therefore paramount to curb the increasing prevalence of overweight and obesity and particularly in reproductive-age women as a population most susceptible to weight gain. The preconception, pregnancy and postpartum periods are key windows of opportunity for weight gain prevention. Lifestyle improvement targeting women at these key life stages to achieve healthy pre-pregnancy BMI, optimal gestational weight gain and reduce postpartum weight retention will not only reduce the risk of maternal overweight and obesity and associated comorbidities but also improve fertility, pregnancy outcomes and the health of the next generation.

Despite the importance of preventing weight gain in reproductive-aged women \([71,72]\), the majority of these women fail to meet population level recommendations for intake of healthy core food group intakes \([73,74]\), consume unhealthy proportions of discretionary
choices [75], have inadequate micronutrient intake [76,77], have suboptimal PA [78] and a high frequency of television watching [79,80]. Whilst there is some research that micronutrients (for example B vitamin intake in excess of recommendations) may contribute to overweight/obesity especially in women in developed countries [81,82], this area of research was not within the scope of the review. Lifestyle changes including optimizing core food groups of fruits, vegetables, whole grains, protein and dairy or alternatives, minimizing intake of discretionary or non-core foods, which are commonly energy-dense or nutritionally poor, and engaging in regular PA will aid in preventing weight gain. The relationship of diet and PA with weight gain and lifestyle interventions to prevent weight gain has been extensively researched in the general population. However, it is not clear what key diet and PA components contribute to weight gain in reproductive-age women at the key life stages of preconception, pregnancy and postpartum that can assist in tailoring future interventions. Hence, the purpose of this narrative review was to synthesize the literature exploring associations of diet and PA with weight gain from both epidemiologic studies and lifestyle interventions to prevent weight gain and aid in the identification of key components to target in the reproductive-life stages of women. Our narrative review compliments and extends the systematic reviews conducted to date for the general adult population by focusing solely on reproductive-aged women, and reporting for the first time on this cohort as well as on the specific life phases of preconception, pregnancy and postpartum; the definitions of these life phases are provided below. Additionally, this review identifies current gaps within this evidence base and informs directions for future research.

2. The Association of Diet and Physical Activity with Weight

2.1. Diet, Physical Activity and Weight Gain in Reproductive-Aged Women

A summary of studies assessing the association of diet and PA with weight gain in reproductive-aged women (aged 18–50 years) are shown in Table 1. The studies were sourced from the following databases: Ovid Medline, EMBASE, CINAHL Plus, PsycINFO and all EBM reviews using the following search terms: “weight gain/or weight adj2 (gain or change) or bmi adj2 (gain or change) or (body mass index) adj2 (gain or change) AND diet/or diet therapy/or diet* or nutri* or nutrition/or physical activity or exercise AND women/or women’s health/or women or woman”. Papers published from 2000 onwards were included if they focused on diet and/or PA and weight gain in women of reproductive age. Only studies published in English were included.

2.1.1. Energy Density and Discretionary Choices

A longitudinal study (n = 186) reported that women (aged 24–46 years) who consume diets with higher energy density (≥1.85 kcal/g) gained more weight than women consuming diets with lower energy density (≤1.5 kcal/g) (6.4 kg vs. 2.5 kg) after six years [83]. In this study, women who had lower energy density diets reported significantly lower total energy intakes and consumed fewer servings of baked desserts, refined grains and fried vegetables and more servings of vegetables, fruit, and cereal compared with women who had higher energy density diets. A similar study in a large cohort of women (aged 22–44 years, n = 50,026) followed up for 8 years reported that women who had higher dietary energy density (5th quintile) gained more weight than women who had lower dietary energy density (1st quintile) (6.4 kg vs. 4.6 kg) [84]. Here, a higher energy density represented high intake of saturated and trans fats and refined carbohydrate and lower intake of vegetables and fruits [84]. Weight gain also varied considerably according to the energy density of individual foods and beverages. Consumption of some foods/beverages with low energy density such as soda, potatoes and fruit punches were associated with greater weight gain whereas consumption of some foods with relatively higher energy density such as olive oil and nuts were not associated with weight gain [84]. This implies that selecting foods based on energy density alone can be misleading and that consideration of the status of foods and beverages as core or discretionary also must be considered. Findings from observational studies suggest that increased consumption of sugar sweetened beverages (SSBs) and fruit
juices is associated with weight gain in reproductive-aged women. Schulze et al. [85] reported that women (age 22–44 years, \( n = 51,603 \)) who increased their intake of SSBs from \( \leq 1 \) drink/week to \( \geq 1 \) drinks/day over two 4-year periods (1991–1995 and 1995–1999) gained weight (4.7 kg and 4.2 kg, respectively). Conversely, women who decreased SSBs intake from \( \geq 1 \) drink/day to \( \leq 1 \) drink/week gained 1.5 kg and 0.14 kg, respectively, over the same periods [85]. Similarly, women with increased consumption of fruit juice (\( \leq 1 \) drink/week in 1991 to \( \geq 1 \) drink/day in 1995) gained more weight compared to those with decreased consumption (\( \geq 1 \) drink/day in 1991 to \( \leq 1 \) drink/week in 1995) (4.03 kg vs. 2.34 kg, \( p < 0.001 \)). In the limited research examining fast food intake and weight gain in reproductive-aged women (20–45 years, \( n = 891 \)), a higher frequency of fast-food restaurant use was associated with an increased total energy intake, percentage energy from fat, hamburgers, French fries and soft drinks and weight. On average, an increase of one fast food meal per week was associated with an increase in average energy intake of 234.4 kJ/day and weight gain of 0.72 kg in women over 3 years [86]. It has been reported that the Western dietary pattern (characterized by high intakes of refined grains, red and processed meats, sweets and potatoes) is associated with weight gain. In a prospective study, women (26–46 years, \( n = 51,670 \)) who increased their Western dietary pattern score (low to high quintiles) had increased weight gain (4.6 kg for 1991 to 1995 and 2.9 kg for 1995 to 1999) compared to women who decreased (high to low quintiles) (2.7 kg for 1991 to 1995 and 1.4 kg for 1995 to 1999) [87]. Data from a prospective study that followed women (30–55 years at baseline, \( n = 41,518 \)) for 8 years reported that the percentage of calories from animal fat, saturated and trans-fat, but not monounsaturated or polyunsaturated fat, was also associated with weight gain (1.04 kg; 95% CI 0.81, 1.29) [88], with a stronger association in overweight women.

There are limited observational studies that assess the association between alcohol consumption and weight gain in reproductive-age women. Wannamethee et al. [89] reported that heavy drinking (>30 g/day of alcohol (>3 standard drinks)), but not light to moderate drinking (0.1 to 29.9 g/day), was associated with higher odds of weight gain (\( \geq 5 \) kg over 8 years) (OR 1.64; 95% CI 1.03, 2.61) compared with non-drinkers in women aged 27–44 years (\( n = 49,324 \)). Similarly, normal weight women (age 38 years and above, \( n = 19,220 \)) who consumed a light to moderate amount of alcohol had less risk of having overweight or obesity compared with non-drinkers over 12.9 years [90]. Conversely, an inverse association was reported between alcohol consumption and weight gain with women aged 38 years and above who did not consume alcohol having higher weight gain (3.6 kg; 95% CI 3.45, 3.80) compared with those who consumed 30 g/day (1.6 kg; 95% CI 0.93, 2.18) during 12.9 years follow-up [90].

### 2.1.2. Core Foods

A number of studies have reported inverse associations between fruit and vegetable intake and weight gain in women [91–93] although many of these studies were not conducted solely in reproductive-age women. For example, Vioque et al. [93] reported that higher intake of fruits (3rd quartile, 249 to 386 g/day compared to 1st quintile, <149 g/day) and vegetables (4th quartile, >333 g/day compared to 1st quintile, <166 g/day) were associated with a reduced risk of weight gain (\( \geq 3.4 \) kg over 10 years) (OR 0.31; 95% CI 0.11, 0.85 and OR 0.18; 95% CI 0.05, 0.66, respectively) in women aged 15–80 years (\( n = 206 \)). An increased intake of both fruits and vegetables was also associated with a lower risk of weight gain, with the lowest risk in the fourth quartile (<362 g/day vs. >698 g/day) (OR 0.22; 95% CI 0.06, 0.81). It has also been reported that adequate intake of fruit and vegetables helps to maintain weight in women of reproductive age with overweight or obesity. A cross-sectional study reported that women with overweight/obesity (age 18–49 years, \( n = 279 \)) consuming >5 fruits and vegetables servings/day were 94% more likely to be weight resilient (maintaining a normal weight in a food desert environment) (prevalence ratio 1.94; 95% CI 1.10, 3.43) compared to those consuming <5 servings/day [94]. A “prudent” dietary pattern characterized by high intakes of fruits, vegetables and whole
grains was also associated with less weight gain. Women (26–46 years) with increased “prudent” pattern score gained less weight (1.9 kg for 1991 to 1995 and 0.7 kg for 1995 to 1999) than women with decreased “prudent” pattern score (4.8 and 3.4 kg in the two time periods) [87].

2.1.3. Diet Quality

Diet quality scores represent adherence to population-based dietary guidelines with higher scores generally associated with improved compliance to guidelines [95,96]. A longitudinal study in young women (29–37 years, n = 4287) reported that overall diet quality measured by the Australian Recommended Food Score (ARFS) and fruit and vegetable index (FAVI) was associated with lower weight gain. Young women in the highest tertile of FAVI and ARFS had less weight gain compared with the lowest tertile over 6 years (−1.6 kg; 95% CI −2.4, −0.3) and (−1.6 kg; 95% CI −2.67, −0.56), respectively [97]. Similar recent longitudinal studies also reported that higher diet quality assessed by ARFS or FAVI was associated with less weight gain in young women (aged 27–31 years, n = 4083) over 6 years [98].

2.1.4. Physical Activity

As reported in the general population, there is also evidence of an inverse association between PA and weight gain in women of reproductive age. In a longitudinal study over 8 years in 46,754 healthy women (aged 25–43 years), Mekary et al. assessed time spent in moderate to vigorous exercise (e.g., hiking, jogging, running, bicycling, aerobics/aerobic dance/rowing machine, swimming and weight gain (classified as more than a 5% change) [99]. They found that women who sustained ≥30 min/day of total PA were less likely to gain weight (OR 0.68; 95% CI 0.64, 0.73) compared with women who sustained <30 min/day. A dose–response relationship was observed such that increased duration of daily PA was associated with less weight gain; even an 11–20 min/day increase in PA was found to be beneficial (OR 0.75; 95% CI 0.68, 0.83). Similarly, a 16 year follow up study by Lusk et al. reported that spending 30 min/day in a range of moderate intensity activities, e.g., brisk walking (−1.8 kg; 95% CI −2.05, −1.56) or bicycling (−1.6 kg; 95% CI −2.09, −1.08), was associated with reduced weight gain in premenopausal women (aged 25–45 years, n = 18,414).

In summary, there is evidence on weight gain and diet in reproductive-aged women. However, most studies were conducted in developed countries like the US and Australia and in specific cohorts such as the Nurses’ Health study and the Australian Longitudinal Study on Women Health, which makes it difficult to generalize findings to other women of reproductive age worldwide. Overall, findings suggest that increased consumption of discretionary foods or Western diets characterized by high energy-dense foods including highly processed foods or fast food, refined carbohydrates and lower fiber foods may contribute to increased weight gain over time in women of reproductive age. Conversely, increased core food intake including fruits and vegetables and a high fiber diet are inversely associated with weight gain. Insufficient or low levels of PA contributes to long-term weight gain.

2.2. Diet, Physical Activity and Weight Gain during Pregnancy

The 2009 IOM guidelines recommend an optimal range of GWG based on pre-pregnancy BMI. For a singleton pregnancy this is 12.7–18.1 kg, 11.3–15.9 kg, 6.8–11.3 and 5.0–9.1 kg for women with underweight, normal weight, overweight and obesity, respectively [45]. A summary of studies assessing diet, PA and weight gain during pregnancy are shown in Table 2. The studies were sourced from the following databases: Ovid Medline, EMBASE, CINAHL Plus, PsycINFO and all EBM reviews using the following search terms: “gestational weight gain/or weight adj2 (excess gain or change) or bmi adj2 (gain or change) or (body mass index) adj2 (gain or change) AND diet/or diet therapy/or diet* or nutrit* or nutrition/or physical activity or exercise AND pregnancy/or pregnant
women or woman”. Papers published from 2000 onwards were included if they focused on diet and/or PA and excessive GWG during pregnancy. Only studies published in English were included.

Table 1. Summary of studies that assessed diet, physical activity and weight gain in reproductive-age women.

| Reference        | Study Design                               | Study/Participant Information                  | Dietary and PA Factors Examined                                                                 | Key Findings                                                                 |
|------------------|--------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Savage 2008 [83] | Prospective cohort study                   | Age: 24–46 yrs. Follow-up: 6 yrs. n = 186     | Dietary ED (kcal/g), calculated from the energy content of all foods (excluding beverages)      | Women consuming higher ED (≥1.85 kcal/g) gained more weight than women consuming lower ED (ED ≤ 1.5 kcal/g) (6.4 kg vs. 2.5 kg). |
| Bes-Rastrollo 2008 [84] | Prospective cohort study (The Nurses’ Health Study II) | Age: 24–44 yrs. Follow-up: 8 yrs. n = 50,026   | Dietary ED (kcal/g), calculated from the energy content of all foods (without and with excluding beverages) | Increased total dietary ED was associated with a greater weight gain. Women who had higher ED (5th quintile, 1.46 kcal/g) gained more weight than women who had lower dietary ED (1st quintile, 0.83 kcal/g) (6.4 kg vs. 4.6 kg). |
| Field 2007 [88]  | Prospective cohort study (The Nurses’ Health Study) | Age: 30–55 yrs. Follow-up: 8 yrs. n = 41,518   | Dietary fats; percentage of calorie from monounsaturated, polyunsaturated, animal, saturated and trans fats | Percentage of calories from animal, saturated and trans-fats was strongly associated with weight gain. For every percentage increase in calories from trans-fat, there was an average weight gain of 1.04 kg (95% CI 0.81, 1.29). |
| Schulze 2004 [85] | Prospective cohort study (The Nurses’ Health Study II) | Age: 24–44 yrs. Follow-up: 8 yrs. n = 51,603 | Consumption of SSBs, soft drinks | Women with increased intake of SSBs from <1 drink/week to >1 drinks/day increased weight (4.7 kg during 1991–5 and 4.2 kg during 1995–9). Women who decreased SSBs intake from >1 drink/day to <1 drink/week decreased weight (1.5 kg during 1991–5 and 0.14 kg 1995–9). Increased consumption of fruit juice from <1 drink/week to >1 drink/day increased weight (4.0 kg during 1991–5 vs. 2.3 kg during 1995–9). |
| Schulze 2006 [87] | Prospective cohort study (The Nurses’ Health Study II) | Age: 26–46 yrs. Follow-up: 8 yrs. n = 51,670 | Dietary patterns | Women who had an increased Western pattern score gained more weight gain (4.6 kg for 1991 to 1995 and 2.9 kg for 1995 to 1999) than women who had lower Western pattern score (2.7 and 1.4 kg for the two time periods). Women who had an increased Prudent pattern score, characterized by high intakes of fruits, vegetables and whole grains, gained less weight (1.9 kg for 1991 to 1995 and 0.7 kg for 1995 to 1999) compared to women with decreased Prudent pattern score (4.8 and 3.4 kg for the two time periods). |
| French 2000 [86] | Prospective cohort study (The Nurses’ Health Study II) | Age: 26–46 yrs. Follow-up: 3 yrs. n = 891     | Dietary intake, fast food restaurant use | A higher frequency of fast-food restaurant use was associated with an increased total energy intake, percentage energy from fat, hamburgers, French fries and soft drinks and weight. On average, an increase of 1 fast food meal per week was associated with an increase of 234.4 kJ/day and weight gain of 0.72 kg in women. |
| Boggs 2011 [91]  | Prospective cohort study                   | Age: 21–54 yrs. Follow-up: 14 yrs. n = 41,351 | Dietary patterns | Vegetables/fruit consumption pattern was associated with significantly less weight gain (10.9 and 11.9 kg in the highest and lowest quintiles). Meat/fried foods pattern was associated with significantly greater weight gain (12.0 and 10.2 kg in the highest and lowest quintiles). |
| Vioque 2008 [92] | Prospective cohort study                   | Age: 15–80 yrs. Follow-up: 10 yrs. n = 206    | Fruit and vegetable intake | Compared to women who were in the lowest quartile of fruit consumption (<149 g/day), women in the third quartile (249–586 g/day) reduced their risk of gaining ≥ 3.41 kg weight by 69% (OR 0.31; 95% CI 0.11, 0.85). Higher vegetable intake also reduced the risk of weight gain in women of the fourth quartile (>333 g/day) (OR 0.18; 95% CI 0.05–0.66). The combined intake of fruits and vegetables decreased the risk of weight gain across quartiles, with the lowest risk among those in the fourth quartile (>689 g/day) (OR 0.22; 95% CI 0.06, 0.81) compared to those in the first quartile (<362 g/day). |
### Table 1. Cont.

| Reference          | Study Design          | Study/Participant Information | Dietary and PA Factors Examined | Key Findings                                                                                                                                                                                                 |
|--------------------|-----------------------|-------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aljadani 2013 [97] | Prospective cohort study | Age: 29–37 yrs. Follow-up: 6 yrs. \( n = 4287 \) | Diet quality assessed by FAVI and ARFS | Women in the highest tertile of FAVI had less weight gain \((-1.6 \text{ kg}; 95\% \text{ CI } -2.4, -0.3)\). Similarly, women in the highest tertile of the ARFS had less weight gain compared with the lowest tertile \((-1.6 \text{ kg}; 95\% \text{ CI } -2.67, -0.56)\). |
| Aljadani 2020 [98] | Prospective cohort study | Age: 27–31 yrs. Follow-up: 6 yrs. \( n = 4083 \) | Diet quality assessed by FAVI and ARFS | Every one-point increase in either the ARFS or FAVI score was associated with significantly less weight gain, 33 and 12 g, respectively. Women in the highest ARFS tertile gained significantly less weight compared with women in the lowest ARFS tertile \((3.7 \text{ kg vs. } 4.1 \text{ kg})\). |
| Wannamethee 2004 [89] | Prospective cohort study (The Nurses Health Study II) | Age: 27–44 yrs. Follow-up: 8 yrs. \( n = 49,324 \) | Alcohol consumption | Heavy drinking \((>30 \text{ g/day})\) was associated with higher odds of weight gain \((\geq 5 \text{ kg})\) \((\text{OR } 1.6; 95\% \text{ CI } 1.03, 2.61)\) compared with non-drinkers, particularly in younger women, but light to moderate drinking \((<30 \text{ g/d})\) was not associated with weight gain. |
| Wang 2010 [90]     | Prospective cohort study | Age: 38 yrs and above. Follow-up: 12.9 yrs. \( n = 19,220 \) | Alcohol consumption | Women who did not consume alcohol had higher weight gain \((3.6 \text{ kg}; 95\% \text{ CI } 3.45, 3.80)\) compared with those who consumed \(30 \text{ g/day}\) \((1.6 \text{ kg}; 95\% \text{ CI } 0.93, 2.18)\). Normal-weight women who consumed a light to moderate amount of alcohol gained less weight and had a lower risk of overweight/obesity compared with non-drinkers \((0 \text{ to less than } 5, 5 \text{ to less than } 15, 15 \text{ to less than } 30, \geq 30 \text{ g/day})\): \((\text{RR } 0.96; 95\% \text{ CI } 0.93, 1.01), (\text{RR } 0.86; 95\% \text{ CI } 0.80, 0.92), (\text{RR } 0.70; 95\% \text{ CI } 0.62, 0.79)\) and \((\text{RR } 0.73; 95\% \text{ CI } 0.62, 0.85), \text{respectively})\). |
| Mekary 2009 [99]   | Prospective cohort study (The Nurses’ Health Study II) | Age 25–43 yrs. Follow-up: 8 yrs. \( n = 46,754 \) | PA: activities such as walking or hiking, jogging running, bicycling, aerobics, swimming | Women who sustained \(\geq 30 \text{ min/day}\) of total PA were less likely to gain weight \((5\% \text{ change})\) \((\text{OR } 0.68; 95\% \text{ CI } 0.64, 0.73)\) compared with women who sustained \(<30 \text{ min/day}\). |
| Lusk 2010 [100]    | Prospective cohort study (The Nurses’ Health Study II) | Age: 25–45 yrs. Follow-up: 16 yrs. \( n = 18,414 \) | PA: bicycle riding, brisk walking, time spent during these activities (minutes/day) | Bicycle riding and brisk walking were associated with less weight gain with an inverse dose–response relationship. For a 30 min/day increase in activity, weight gain was significantly less for brisk walking \((-1.8 \text{ kg}; 95\% \text{ CI } -2.05, -1.56)\) and bicycling \((-1.6 \text{ kg}; 95\% \text{ CI } -2.09, -1.08)\). |

Abbreviations: ARFS = Australia Recommended Food Score; BMI = Body Mass Index; CI = confidence interval; ED = dietary energy density; FAVI = Fruit and Vegetable Index; OR = odd ratio; PA = physical activity; RCTs = randomized controlled trials; SSBs = sugar-sweetened beverages; yrs = years.

### 2.2.1. Discretionary Choices

Systematic reviews of observational studies consistently report that excessive GWG is positively associated with higher energy intake [101,102]. Several observational studies evaluated the effect of higher intake of added sugar-containing foods and GWG [103–105]. A large prospective cohort study of 46,262 Danish women with singleton pregnancies reported that women with an intake of added sugar in the highest quintile \((89 \text{ g/day})\) had a higher rate of GWG \((\text{additional } 34 \text{ g/week}; 95\% \text{ CI } 28, 40)\) compared to women in the lowest quintile \((19 \text{ g/day})\) and overall gained an extra \(1.4 \text{ kg}\) during pregnancy [103]. The study further reported that the intake of confectionary (primarily chocolate and mixed candy) was directly associated with GWG \((\text{additional } 51 \text{ g/week}; 95\% \text{ CI } 45, 58)\) [103]. A study that analyzed data from 495 pregnant women reported that women who consume more confectionary in early pregnancy \((11–15 \text{ weeks of gestation})\) had increased risk of excess GWG \((\text{OR } 2.52; 95\% \text{ CI } 1.10, 5.77)\) [104]. Similarly, women who had a higher intake of added sugar containing foods \((\geq 2 \text{ day})\) gained more weight \((5.4 \text{ kg}; 95\% \text{ CI } 2.1, 8.7)\) compared with women who had a lower \((<1 \text{ week})\) intake [105]. Unhealthy dietary patterns such as higher consumption of fast foods [106], ultra-processed foods [107], Western dietary...
patterns characterized by energy-dense, processed, high sugar and fat foods \([108,109]\) and fried foods \([110]\) during pregnancy are also associated with excessive GWG.

### 2.2.2. Core Foods

An inverse association between fruit and vegetable intake and GWG has been reported in some \([111,112]\) but not all \([113]\) studies. A prospective cohort study in pregnant women \((n = 622)\) reported a significantly lower GWG among those who had \(\geq 3\) compared with \(< 3\) servings/day of fruits and vegetables \([112]\). Consuming increasing daily cup equivalents of fruits and vegetables during pregnancy also reduced the risk of excessive GWG (OR 0.77; 95% CI 0.60, 0.97) \([111]\).

Dietary patterns high in dairy products, fruits, vegetables, and nuts and seeds during pregnancy reduce excessive GWG \([114]\). Furthermore, healthy dietary patterns including “New Nordic Diet”, “prudent” and the Mediterranean diet have been reported to be associated with lower risk of excessive GWG. A prospective cohort study assessed the New Nordic Diet (NND), characterized by higher consumption of fruits and vegetables, whole grains, potatoes, fish, game, seafood, milk and drinking water, in 66,597 pregnant women and reported that women with normal weight with high adherence to NND had significantly lower odds of excessive GWG (OR 0.93; 95% CI 0.87, 0.99) compared to women with low adherence \([115]\). In a retrospective cohort study, women \((n = 1432)\) with low Mediterranean diet adherence were twice at risk of excessive GWG (OR 1.9; 95% CI 1.52, 2.37) \([116]\).

Observational studies have reported conflicting findings on the relationship between macronutrients and GWG. While a systematic review of observational studies reported that GWG was positively associated with increased total energy intake, the association of specific macronutrient intake and GWG was inconsistent \([102]\). Several prospective studies reported no association between total fat or saturated fat intake and excessive GWG \([114,117,118]\). In contrast, a study in Pakistan in 157 women reported that higher total fat intake was associated with higher GWG \([119]\). A cross-sectional analysis of 224 pregnant women in the US reported a positive association between GWG and animal fat but not vegetable fat intake \([120]\). With regard to protein and excessive GWG, studies have reported either no \([106,118]\), inverse \([121]\) or positive associations \([120]\). With regard to carbohydrate, women with high carbohydrate intake (430–629 g/day) during the second trimester had greater GWG (2.3 kg; 95% CI 0.43, 4.08) \([122]\) than women with low carbohydrate intake (229–429 g/day). A recent study reported that consumption of lower carbohydrate diet (% kcal < 49.6%) was associated with less GWG in women with obesity compared to a higher carbohydrate diet (% kcal > 49.6%) (7.9 vs. 13.1 kg), but an opposite pattern was reported in women with normal weight (16.6 vs. 12.9 kg) \([123]\). Conversely, carbohydrate intake at 27 weeks of gestation was associated with reduced GWG in all BMI groups \([120]\), supported by a systematic review of observational studies \([101]\). A study by Rugină et al. \([121]\), however, reported no significant association between a carbohydrate-based diet and GWG.

### 2.2.3. Diet Quality

Studies assessing the association between diet quality and GWG are limited. A cross-sectional study measured diet quality by the 2005 Healthy Eating Index (HEI-2005), reflecting adherence to the MyPyramid US dietary guidelines, and reported no associations between the HEI-2005 and excessive GWG after adjustment for several potential confounders \([114]\). However, in a prospective cohort study by Yong et al. \([124]\) higher diet quality assessed by the modified Healthy Eating Index for Malaysians (HEI) (reflecting compliance with recommendations for intake of cereals and grains, vegetables, fruits, dairy or alternatives and meat, egg and legumes) in the second and third trimesters were significantly associated with reduced risk of excessive GWG in women with normal weight \([124]\). A recent study in Sweden evaluated diet quality and its effect on GWG using the National Food Agency’s index which was designed to assess compliance with dietary recommenda-
2.2.4. Physical Activity

PA declines during pregnancy [126] and this is independently associated with a greater GWG [113,127], regardless of pre-pregnancy BMI [113]. PA therefore plays a significant role in promoting optimal weight gain during pregnancy. Several observational studies consistently report that higher levels of PA during pregnancy are associated with reduced risk of excessive GWG [118,128–132]. PA, including total, walking and vigorous activity, was inversely associated with excessive GWG in a large prospective cohort study of 1388 pregnant women. Specifically, 30 min walking per day (OR 0.92; 95% CI 0.83, 1.01), 30 min vigorous PA per day (OR 0.76; 95% CI 0.60, 0.97) and 30 min per day total PA (OR 0.95; 95% CI 0.89, 1.01) were associated with lower excessive GWG during mid-pregnancy [118]. Conversely, Ehrlich et al. [128] (n = 1055) reported that only vigorous-intensity PA was associated with reduced odds of excess GWG (OR 0.63; 95% CI 0.40–0.99) and in women with overweight/obesity (OR 0.46; 95% CI 0.27, 0.79) with no associations reported for moderate-intensity exercise [128]. A prospective cohort study evaluated the role of PA and excessive GWG in 2767 pregnant women and reported that women engaging in ≥150 min/week had reduced odds of GWG exceeding the IOM recommendations (OR 0.71; 95% CI 0.57, 0.88) compared with women with low level of PA (<60 min/week) [132].

In summary, while increased energy intake during pregnancy contributes to excessive GWG, evidence on the contribution of macronutrients is inconsistent. Unhealthy dietary patterns characterized by high saturated fat, refined grains, added sugars and low fiber foods may contribute to excessive GWG. Conversely, increased consumption of core food groups including fruits, vegetables and whole grains, high-quality diet and reducing consumption of discretionary choices may promote optimal GWG and lower risk of excessive GWG. There is sufficient evidence that moderate to vigorous PA during pregnancy is associated with reduced excessive GWG. However, there are limited data specifically on the amount of PA required to prevent excessive GWG.

**Table 2. Summary of studies assessed diet, physical activity and weight gain during pregnancy.**

| Reference          | Study Design                | Study Participant ‡ | Dietary and PA Factors Examined | Key Findings                                                                 |
|--------------------|-----------------------------|---------------------|---------------------------------|------------------------------------------------------------------------------|
| Tielemans 2016 [102] | Systematic review           | 56 studies (46 observational studies; 47 longitudinal and 1 case-control study; 10 intervention studies (2 RCTs)) | Energy and macronutrients (carbohydrate, protein and fat intake) | Longitudinal studies: Higher energy intake during pregnancy associated with excessive GWG (20/42 studies reported an association between energy intake and GWG). Intervention studies: 9/10 studies reported an association between energy intake and GWG. The association between macronutrient intake and excessive GWG was inconsistent. |
| Streuling 2011 [101]  | Systematic review           | 12 cohort studies   | Energy intake, protein intake   | Energy intake was associated with GWG (7/12 studies). Intake of calories from protein, carbohydrate and vegetables was associated with reduced GWG. |
| Pathirathna 2017 [122] | Prospective cohort study     | n = 141             | Carbohydrate intake             | Women with moderate carbohydrate intake (430–629 g/day) gained higher GWG than women with lower carbohydrate intake (229–429 g/day) (2.3 kg; 95% CI 0.43, 4.08) in the second trimester. |
| Wrottesley 2017 [108]  | Prospective cohort study     | n = 538             | Dietary patterns                 | Traditional diet pattern (characterized by high intake of whole grains, legumes, vegetables and traditional meats and decreased intake of refined, high sugar and fat foods) was associated with reduced excessive GWG (OR 0.81; 95% CI 0.69, 0.94). |
| Reference          | Study Design      | Study Participant | Dietary and PA Factors Examined | Key Findings                                                                                                                                                                                                 |
|--------------------|-------------------|-------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shin 2016 [133]    | Cross-sectional   | n = 391           | Dietary patterns                | Women in the mid tertile of Mixed pattern score (characterized by high loadings of added sugar, butter, cheese, cold breakfast cereals, cured meat, dairy products, fruit drinks, fruits, vegetables, high-energy drinks, legumes, nuts and seed, pizza, potatoes, poultry, refined and whole grains) had lower odds of excessive GWG (OR 0.39; 95% CI 0.15, 0.99). |
| Renault 2015 [105]| RCT               | n = 342           | Dietary composition, Adherence to a hypocaloric diet (5000-7000 kJ), low in saturated fat, Mediterranean-style | Higher energy intake (per 500 kcal increment) was associated with greater GWG z-scores (0.18, 95% CI 0.13, 0.23). Substitution of carbohydrate for fat (per 5% energy substitution) were associated with greater GWG (0.07; 95% 0.03, 0.12). Higher intakes (3rd tertile) of plant-based protein foods were associated with a lower risk of excessive GWG compared to lower intake (1st tertile) (RR 0.66; 95% CI 0.46, 0.94). |
| Lai 2019 [134]     | Prospective cohort study | n = 960         | Energy intake, macronutrients, food groups | An increase in Western dietary pattern score (from 1st to 3rd tertile) (characterized by a high intake of red meat, fries, dipping sauces and salty snacks) was associated with increased GWG (1.2 kg, p = 0.013). |
| Maugeri 2019 [109]| Prospective cohort study | n = 232           | Dietary patterns                | Highest quintile (1.4 z-score) of protein to carbohydrate ratio had a lower rate of GWG (–16 g/day; 95% CI –22, –9.0) compared to women with the lowest quintile (–1.3 z-score). Women with an intake of added sugar in the highest quintile (89 g/day) compared to the lowest quintile (19 g/day) had a higher rate of weekly weight gain (34 g/week; 95% CI 28–40 g/week). |
| Maslova 2015 [103] | Prospective cohort study | n = 46,262        | Macronutrients, protein-to-carbohydrate ratio, added sugar | Poor dietary quality (score ≤ 4) was associated with higher odds of excessive GWG (OR 4.4, p = 0.01) compared with a high-quality diet score (score ≥ 9). |
| Augustin 2020 [125]| Prospective cohort study | n = 2125           | Dietary quality score (score 0-12) assessed by the National Food Agency’s index designed to assess fibre, fat and discretionary choices | Poor dietary quality (score ≤ 4) was associated with higher odds of excessive GWG (OR 4.4, p = 0.01) compared with a high-quality diet score (score ≥ 9). |
| Lagiou 2004 [120]  | Prospective cohort study | n = 224           | Energy intake, macronutrients   | Weight gain at the end of the second trimester was positively associated with energy intake (kcal/day) (0.9 kg/SD, p = 0.006) as well as energy-adjusted intakes of protein and lipids of animal origin (3.1 kg/SD, p < 0.001; 2.6 kg/SD, p < 0.001, respectively) but negatively associated with energy-adjusted intakes of carbohydrates (–5.2 kg/SD, p < 0.001). |
| Uusitalo 2009 [106]| Retrospective cohort study | n = 3360           | Dietary patterns, food groups   | Fast food dietary pattern was associated with higher rate of weight gain (0.01 kg/week). The rate of weight gain was significantly associated with energy intake (0.016 kg/week), % energy from protein (–0.004 kg/week), % energy from saturated fatty acid (0.002 kg/year) and % energy from sucrose (0.002 kg/week). |
### Table 2. Cont.

| Reference         | Study Design               | Study Participant ‡ | Dietary and PA Factors Examined                                                                 | Key Findings                                                                                                                                 |
|-------------------|---------------------------|--------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Stuebe 2009 [118] | Prospective cohort study  | n = 1388           | Energy intake, food groups and types including fried foods, dairy, fruits and vegetables, red and processed meats, whole grains | Total energy intake 500 kcal/day (OR 1.10; 95% CI 1.00, 1.22), total dairy serving/day (OR 1.08; 95% CI 1.00, 1.17) and fried foods serving/day (OR 3.47; 95% CI 0.91, 13.24) were associated with excessive GWG. Vegetarian diet in the first trimester was inversely associated with excessive GWG (OR 0.45; 95% CI 0.27, 0.76). |
| Deierlein 2008 [135] | Prospective cohort study  | n = 1231           | Dietary energy density, energy intake, carbohydrates                                              | Compared with women in the 1st quartile of mean dietary energy density (0.71 kcal/g), women in the 3rd quartile (0.98 kcal/g) and 4th quartile (1.21 kcal/g) gained excess total GWG (1.13 kg; 95% CI 0.24, 2.01), (1.08 kg; 95% CI 0.20, 1.97), respectively. |
| Hillesund 2014 [115] | Prospective cohort study  | n = 66,597         | Diet quality assessed by NND (score 0–10)                                                       | High adherence to NND (score 6–10) (representing intake of fruits, vegetables, whole grains, potatoes, fish, game, milk) was associated with lower odds of excessive GWG (OR 0.93; 95% CI 0.87, 0.99) in women with normal weight. |
| Yong 2016 [127]   | Cross-sectional study     | n = 589            | PA: moderate-vigorous-intensity activity                                                        | Pregnant women with low PA level were more likely to have excessive GWG than women with high PA level (OR 1.74; 95% CI 0.77, 3.97). |
| Harris 2015 [130] | Cross-sectional study     | n = 856            | PA: walking, jogging, aerobics, swimming                                                       | Women who engaged in PA at least 3 times a week for 6–9 months during pregnancy had reduced odds of excessive GWG (OR 0.26; 95% CI 0.12, 0.56). |
| Kraschnewski 2013 [132] | Prospective cohort study  | n = 2767           | PA: minutes per day engaging in regular PA                                                       | Pregnant women who engaged in ≥150 min/week had reduced odds of excessive GWG (OR 0.71; 95% CI 0.57, 0.88) compared with inactive women (<60 min/week). |
| Stuebe 2009 [118] | Prospective cohort study  | n = 1388           | PA: light-to-moderate activities, vigorous activity, total activity (minutes per week)         | Vigorous activity, walking and total activity during pregnancy were associated with reduced GWG. 30 min walking/day (OR 0.92; 95% CI 0.83, 1.01), 30 min vigorous PA/day (OR 0.76; 95% CI 0.60–0.97) and 30 min total PA/day (OR 0.95; 95% CI 0.89, 1.01) were associated with lower excessive GWG during mid-pregnancy. |
| Ehrlich 2016 [128] | Prospective cohort study  | n = 1055           | PA: moderate-intensity and vigorous-intensity                                                   | Vigorous-intensity exercise was associated with reduced odds of excessive GWG (OR 0.63; 95% CI 0.40–0.99) overall and in women with overweight/obesity (BMI ≥ 25.0 kg/m²) (OR 0.46; 95% CI 0.27, 0.79) but no associations were reported for moderate-intensity exercise. |
| Jiang 2012 [131]  | Prospective cohort study  | n = 862            | PA: daily pedometer step counts                                                                | Active pregnant women (≥10,000 daily steps) had lower odds of excessive GWG (OR 0.60; 95% CI 0.35, 1.03) than sedentary women (<5000 daily steps) in the last two trimesters. |

‡ Women with singleton pregnancies; Abbreviations: BMI = Body Mass Index; CI = confidence interval; GWG = Gestational weight gain; MD = Mean difference; NND = New Nordic Diet score; OR = odd ratio; PA = Physical activity; RCT = Randomized controlled trial; SD = standard deviation of intake.

### 2.3. Diet, Physical Activity and Weight Gain during Preconception and Postpartum

Observational studies assessing associations of diet and PA in preconception and postpartum with weight gain are lacking. Here, preconception is defined as the period in the weeks to months years before pregnancy for women with a conscious intention or desire to conceive [136] and postpartum is the time period after delivery up to 2 years.

We searched for papers using the databases: Ovid Medline, EMBASE, CINAHL Plus, PsyclINFO and all EBM reviews and using the following search terms: “weight gain/or weight adj2 (gain or change) or bmi adj2 (gain or change) or (body mass index) adj2
(gain or change) AND diet/or diet therapy/or diet* or nutrit*/or/lifestyle/or exercise AND postpartum or preconcept* or preg* or pregestation* or periconception* or prepregnancy* or prenatal or pre-pregnancy/or postpartum period/or postpartum women. Papers published from 2000 onwards were included if they focused on diet and/or PA and weight gain during preconception and postpartum. Only studies published in English were included.

Only one longitudinal study was identified in preconception. This explored dietary patterns in preconception, pregnancy, postpartum and their association with BMI in 80 Spanish women [71]. This study identified the ‘sweetened beverages and sugars’ pattern from preconception to 6 months postpartum and ‘vegetables and meat’ pattern to the end of pregnancy. The ‘vegetables and meat’ pattern was inversely associated with BMI during the preconception period [71]. However, this study did not specifically assess weight gain during the preconception period. Similarly, there are limited studies assessing the association between diet and PA with weight gain during the postpartum period. To date, only one study specifically assessed postpartum weight gain (weight change from 1 to 6 months postpartum) and diet. This recent longitudinal cohort study in 99 women reported that consumption of added sugars, soft drinks, SSBs and high glycemic diets were associated with weight gain in the first 6 months postpartum [137]. The study reported that a half-serving per day (8 fluid ounces (236.6 mL)) increase of all soft drinks (1.5 kg; 95% CI 0.70, 2.34), increased intake of added sugar (g/day) (0.05 kg; 95% CI 0.004, 0.10), a half 8-ounce serving per day increase in SSBs (0.69 kg; 95% CI 0.06, 1.32), a high glycemic index (bread as comparator) (0.25 kg; 95% CI 0.07, 0.42) and glycemic load (bread comparator) (0.04 kg; 95% CI 0.002, 0.08) were associated with postpartum weight gain, whereas a 1 g/day increment of soluble fiber intake was associated with a decrease in postpartum weight gain (−0.8 kg; −1.35, −0.29) [137].

In contrast, there are several observational studies investigating the association between postpartum weight retention and diet including total energy [138], dietary patterns [72,139,140] or macronutrients (total fat, carbohydrate, protein, saturated fat, and trans-fat and the glycemic index) [141,142], fried food and SSB intake [143,144]. The finding of another recent study also reported that lower diet quality was associated independently with postpartum weight retention despite no association reported in prior studies [72,145]. Total energy intake, regardless of diet composition [72], trans fat intake [141] and discretionary foods [146], has also been reported to be associated with postpartum weight retention. Predictors of postpartum retention including diet and physical activity has been extensively discussed in recent reviews [147].

Finally, there is insufficient evidence on PA and weight gain during the postpartum period or postpartum weight loss [148]. A prospective cohort study (n = 1617) reported that total PA (>163.3 MET-hour/week) was inversely associated with weight retention (−0.50 kg; 95% CI −0.94, −0.07) and (−0.66 kg 95% CI −1.09, −0.23) at 6 and 12 months postpartum, respectively, compared to lower total PA (≤133.2 MET-hour/week) [149]. Of those women who were physically active before pregnancy, more than 50% remained sedentary during the postpartum period which may contribute to postpartum weight gain or retention [150]. However, Most et al.’s [138] prospective cohort study of 37 women with obesity found no association of PA or diet quality but a positive association of energy intake with postpartum weight retention. They concluded that weight gain or weight retention during the postpartum period was the result of increased energy intake rather than decreased energy expenditure in women with obesity [138].

In summary, despite the importance of understanding the key contributions of diet and PA in preconception and postpartum to weight gain, there is a lack of research assessing this specific reproductive life stage and a lack of clarity on specific dietary and PA needs to target for the prevention of weight gain through lifestyle modification. This emphasizes the need for observational studies exploring diet and PA components associated with weight gain in preconception and postpartum.
3. Interventions for Preventing Weight Gain in Women

3.1. Weight Gain Prevention in Reproductive-Age Women

Several studies have been published investigating lifestyle interventions targeting the association of diet and PA with weight gain prevention in women of reproductive age. A randomized controlled trial (RCT) reported that interventions focusing on healthy eating and PA in 622 low-income mothers with overweight/obesity aged 18–34 years were not effective in preventing further weight gain [151]. Metzgar et al. [152] also conducted a RCT which aimed to prevent weight gain in women aged 18–45 years with a BMI of >18.5 kg/m² through nutrition and PA education (emphasizing general nutrition, vegetable consumption, portion control, breakfast consumption, healthy snacking and beverage choices, nutrient density, family menu planning, grocery shopping and PA). This comprised a 12-month intervention with a one-hour nutrition session delivered by a registered dietitian or counsellor weekly for the first 4 months followed by monthly sessions. No significant difference was found between women who received the weight gain prevention intervention and those randomized to a control group. Similarly, Levine and colleagues [153] found no significant effect on weight gain in normal weight and overweight women who received 15 group education sessions or 15 correspondence education lessons compared with an information-only control over three years. Both interventions focused on self-monitoring of energy intake and expenditure and changes in dietary intake such as the substitution of low-fat foods for high-fat and provided a 12-month gym membership [153].

In contrast, Bennett et al. [154] evaluated the effectiveness of weight gain prevention interventions in overweight women aged 25 to 44 years in a rural community health center setting. The intervention was based on the energy deficit approach with tailored behavior change goals (e.g., replacing energy-dense foods with five or more fruits and vegetables/day, no fast food or SSBs) and behavioral change strategies which were reinforced by monthly counselling calls by a trained registered dietitian. Women in the intervention group reduced weight gain compared to usual care (−1.0 vs. 0.5 kg, mean difference between groups −1.4 kg (95% CI −2.8, −0.1)). A 12 months pragmatic cluster randomized controlled trial in 492 women aged 18–50 years by Lombard and colleagues [155] compared women in the control group (receiving one general women’s health education session) with those receiving self-management lifestyle intervention (HeLP-her) through a group session, monthly SMS text messages, one phone coaching session, and a program manual. The intervention was effective in preventing weight gain (−0.5 kg; 95% CI −0.99, 0.03) compared to control group (0.4 kg; 95% CI −0.09, 0.97). A similar study also reported the effectiveness of a low-intensity self-management intervention (simple health messages, behavior change strategies, 3 group sessions and monthly support using mobile telephone text messages for 12 months) in preventing weight gain compared to control (non-interactive information session based on population dietary and PA guidelines) in 250 women aged 25–51 years with young children [156]. In a recent meta-analysis of lifestyle intervention trials targeting adults aged 18–50 years, subgroup analysis by gender (17 studies) showed significant weight reduction following lifestyle interventions compared to controls in women aged 18–50 years (MD −0.92 kg; 95% CI −1.49, −0.36) [39].

In summary, although there are mixed findings in relation to the success of lifestyle interventions targeting diet and PA to prevent weight gain overall, there is evidence of efficacy of diet and PA interventions for weight gain prevention in women of reproductive age. This suggests that we can support women’s health during these important life years.

3.2. Prevention of Excessive Gestational Weight Gain during Pregnancy

Previous systematic reviews and meta-analyses have reported efficacy of diet and/or PA interventions to reduce excessive GWG [157–164]. The international weight management in pregnancy (iWIP) [161] collaborative group synthesized individual participant data from 36 randomized trials and documented that diet and PA based interventions in pregnancy reduced GWG (MD −0.70 kg; 95% CI −0.92, −0.48) [161]. A systematic
review by Thangaratinam et al. [164] that included 44 RCTs (7278 women) and evaluated diet and/or PA interventions reported a 1.42 kg (95% CI 0.95, 1.89) reduction in GWG with any intervention compared with control. Diet only interventions were most effective (MD $-3.84$ kg; 95% CI $-5.22$, $-2.45$) in reducing GWG than PA (MD $-0.72$ kg; 95% CI $-1.20$, $-0.25$) or combined interventions (MD $-1.06$; 95% CI $-1.67$, $-0.46$). Here, diet only interventions included balanced diets of 18–24 kJ/kg with higher intake of fruits, vegetables and legumes; healthy diets with a maximum of 30% fat, 15–20% protein, and 50–55% carbohydrate or low glycemic diets with unprocessed whole grains and energy intake individualized to the needs of pregnant women. Subgroup analysis by BMI showed a reduction in GWG in all BMI classes (MD $-5.53$ kg; 95% CI $-8.54$, $-2.53$) and women with overweight/obesity (MD $-7.73$ kg; 95% CI $-9.40$, $-6.05$ kg). The PA interventions included light intensity resistance training, weight-bearing exercises and walking for 30 min. The LIFE-Moms consortium [165] conducted several RCTs in pregnant women with overweight and obesity to evaluate the effectiveness of lifestyle interventions in limiting excessive GWG. A prospective meta-analysis of lifestyle intervention trials targeting 1150 women with overweight and obesity showed significant reduction in excessive GWG compared to standard care (MD $-2.18$; 95% CI $-2.18$, $-0.99$) [166].

In general, there is sufficient evidence on successful lifestyle interventions to prevent excess GWG during pregnancy although there is a variation in lifestyle intervention or specific details of the diet and PA components needed for effective interventions. A recent comprehensive review of reviews recommended multi-component lifestyle interventions including a balanced diet with low glycemic index foods and light to moderate-intensity PA 30–60 min per day 3–5 days per week to prevent excessive weight gain during pregnancy [167].

### 3.3. Weight Gain Prevention in Preconception and Postpartum

There is a paucity of research on lifestyle interventions (diet and/or PA) aimed at the prevention of weight gain in preconception. Interventions in the preconception period have focused on improving general nutritional status and health behaviors aimed at improving reproductive health and pregnancy outcomes [168]. While these may indirectly benefit weight, they are generally not directly targeted at preventing weight gain. Despite the lack of literature specific to preconception, there is evidence on effectiveness of lifestyle interventions in preventing weight gain in reproductive-age women, which can be adopted for women in the preconception period. Although the preconception period can be a “teachable moment” for lifestyle modification, opportunities are often missed as nearly half of pregnancies are unplanned [169]. Furthermore, women preconception face several barriers to adopting a healthy lifestyle and weight including lack of knowledge, not planning pregnancy, beliefs about negative consequences of eating healthy food, family pressure and lack of resources [170].

Lifestyle intervention studies targeting weight gain prevention postpartum are also lacking with most of the previous observational studies, trials and systematic reviews and meta-analysis assessing dietary and PA postpartum focusing on reduction of postpartum weight retention [157,171–176]. To our knowledge, no studies have assessed the effect of lifestyle (diet and/or PA) interventions specifically on preventing weight gain postpartum. A recent review of 17 studies assessed dietary changes from pregnancy to postpartum and reported that postpartum women are more likely to have a higher intake of discretionary choices, decreased fruit and vegetable consumption and poor adherence to a healthier dietary pattern during the transition from pregnancy to postpartum [177]. As previously discussed in reproductive-age women overall, these diet components and patterns would likely contribute to further weight gain postpartum. Lifestyle interventions targeting key components such as limiting energy intake from discretionary choices; increasing consumption of core foods including fruits, vegetables and whole grains and engaging in regular PA may therefore aid in preventing weight gain in the postpartum period. Postpartum women also experience many barriers to attaining a healthy lifestyle such as
increased family and time commitments, limited time, lack of motivation and confidence, fatigue and lack of access to appropriate and affordable exercise facilities [178]. Weight gain prevention interventions to support women in the postpartum period should also consider these unique barriers. The postpartum period can also be considered as inter-conception if another pregnancy occurs.

Overall, we summarize here a large body of observational and population-based studies assessing the contribution of diet and PA to weight gain in reproductive age women. While these studies provide important insights with regard to which diet and PA components to target, they are limited with regard to inferring causal mechanisms which should be a focus of future research. Furthermore, observational studies can be influenced by confounding and here often relied on often on self-reported dietary intake and PA which can be subject to recall bias. Similarly, several systematic reviews and meta-analyses of RCTs strongly suggest the effectiveness of lifestyle (diet and/or PA) in reducing weight gain in women of reproductive age and preventing excessive GWG during pregnancy. However, there is a lack of clarity on diet and PA components to be targeted during interventions which need to be addressed in future research. The role of intake of micronutrients with weight gain and weight gain prevention was not addressed in this review. Evidence on the importance of micronutrients and overweight/obesity is evolving and future studies should investigate the effect of micronutrients, nutrient interactions and optimal intake during preconception, pregnancy and postpartum and weight gain in reproductive life stages.

PA is inversely associated with weight and plays a pivotal role in weight gain prevention. Most of the studies included in this review used self-report measures which may overestimate PA. Use of objective measures of PA such as instruments or devices including accelerometers would give less biased results and a more accurate reflection of the amount or type of PA required to prevent weight gain including aspects such as intensity, duration, frequency or time of day. Further studies are required to document associations of objectively measured PA levels with changes in weight.

4. Summary

This comprehensive review summarizes the existing evidence on the relationship between specific diet and PA components with weight gain in women of reproductive age and key reproductive life stages (preconception, pregnancy and postpartum). Furthermore, the review provides an overarching summary of lifestyle intervention studies, primarily RCTs, aimed at preventing weight gain in these population groups. There is clear evidence of a positive association between high energy intake from added sugars, confectionary, saturated fat and processed foods with weight gain and an inverse association between increased consumption of fruits, vegetables and whole grains with weight gain in women of reproductive age. However, further research is required to more clearly understand the effect of these diet components on weight gain in women in key reproductive life stages. It is also evident that increasing PA is inversely associated with weight gain. However, the specific level of PA required to prevent weight gain remains unclear, especially in reproductive life stages. The existing evidence also suggests that lifestyle (diet and/or PA) interventions are effective in reducing weight gain in women of reproductive age and preventing excessive GWG during pregnancy. However, evidence on diet and PA components contributing to weight gain and lifestyle interventions to prevent weight gain specifically during preconception and during postpartum are lacking. There is therefore a need for further research to identify key dietary and PA components targeted at specific reproductive life stages to guide intervention strategies in preventing weight gain. There is also a need for further research to optimize dietary intake and physical activity to ensure optimal energy balance in key reproductive life stages.
Author Contributions: L.J.M. conceptualized ideas, reviewed the manuscript and substantiated with high-level inputs, M.A.A. wrote the initial draft and overall manuscript. M.M., T.P.W., C.L.H. and H.S. reviewed and revised the paper. All authors had a substantial contribution to the restructuring and finalization of the manuscript and read and agreed to the published version of the manuscript.

Funding: M.A.A. and M.M. are funded by the Monash International Tuition Scholarship and Monash Graduate Scholarship; L.J.M. is funded by a National Heart Foundation Future Leader Fellowship.

Conflicts of Interest: The authors declare no conflict of interest.

References
1. Ng, M.; Fleming, T.; Robinson, M.; Thomson, B.; Graetz, N.; Margono, C.; Mullany, E.C.; Biryukov, S.; Abbafati, C.; Abers, S.F. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis of the Global Burden of Disease Study 2013. Lancet 2014, 384, 766–781. [CrossRef]
2. Flegal, K.M.; Graubard, B.I.; Williamson, D.F.; Gail, M.H. Cause-specific excess deaths associated with underweight, overweight, and obesity. JAMA 2007, 298, 2028–2037. [CrossRef] [PubMed]
3. Must, A.; Spadano, J.; Coakley, E.H.; Field, A.E.; Colditz, G.; Dietz, W.H. The disease burden associated with overweight and obesity. JAMA 1999, 282, 1523–1529. [CrossRef] [PubMed]
4. Tremmel, M.; Gerdtham, U.-G.; Nilsson, P.M.; Saha, S. Economic burden of obesity: A systematic literature review. Int. J. Environ. Res. Public Health 2017, 14, 435. [CrossRef]
5. Kelly, T.; Yang, W.; Chen, C.-S.; Reynolds, K.; He, J. Global burden of obesity in 2005 and projections to 2030. Int. J. Obes. 2008, 32, 1431–1437. [CrossRef]
6. World Health Organization. Obesity and Overweight. Available online: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (accessed on 23 February 2021).
7. Brown, W.J.; Kabir, E.; Clark, B.K.; Gomersall, S.R. Maintaining a healthy BMI: Data from a 16-year study of young Australian women. Am. J. Prev. Med. 2016, 51, e165–e178. [CrossRef]
8. da Silva, M.; Weiderpass, E.; Licaj, I.; Rylander, C. Factors associated with high weight gain and obesity duration: The Norwegian Women and Cancer (NOWAC) Study. Obes. Facts 2018, 11, 381–392. [CrossRef] [PubMed]
9. Lewis, C.E.; Jacobs, D.R., Jr.; McCreaith, H.; Kiefe, C.I.; Schreiner, P.J.; Smith, D.E.; Williams, O.D. Weight gain continues in the 1990s: 10-year trends in weight and overweight from the CARDIA study. Am. J. Epidemiol. 2000, 151, 1172–1181. [CrossRef] [PubMed]
10. Ajladani, H.; Patterson, A.; Sibbritt, D.; Collins, C.E. Diet quality and weight change in adults over time: A systematic review of cohort studies. Curr. Nutr. Rep. 2015, 4, 88–101. [CrossRef]
11. Bendsen, N.T.; Christensen, R.; Bartels, E.M.; Kok, F.J.; Sierksma, A.; Raben, A.; Astrup, A. Is beer consumption related to measures of abdominal and general obesity? A systematic review and meta-analysis. Nutr. Rev. 2013, 71, 67–87. [CrossRef]
12. Fogelholm, M.; Anderssen, S.; Gunnarsdottir, I.; Lahti-Koski, M. Dietary macronutrients and food consumption as determinants of long-term weight change in adult populations: A systematic literature review. Food Nutr. Res. 2012, 56, 19103. [CrossRef] [PubMed]
13. Hooper, L.; Abdelhamid, A.; Mooore, H.J.; Douthwaite, W.; Skeaff, C.M.; Summerbell, C.D. Effect of reducing total fat intake on body weight: Systematic review and meta-analysis of randomised controlled trials and cohort studies. BMJ 2012, 345, e7666. [CrossRef]
14. Johnson, L.; Wilks, D.; Lindroos, A.; Jebb, S. Reflections from a systematic review of dietary energy density and weight gain: Is the inclusion of drinks valid? Obes. Rev. 2009, 10, 681–692. [CrossRef]
15. Ledoux, T.; Hingle, M.D.; Baranowski, T. Relationship of fruit and vegetable intake with adiposity: A systematic review. Obes. Rev. 2011, 12, e143–e150. [CrossRef]
16. Louie, J.C.Y.; Flood, V.; Hector, D.; Rangan, A.; Gill, T. Dairy consumption and overweight and obesity: A systematic review of prospective cohort studies. Obes. Rev. 2011, 12, e582–e592. [CrossRef] [PubMed]
17. Lugner, M.; Lafontan, M.; Bes-Rastrollo, M.; Winzer, E.; Yumuk, V.; Farpour-Lambert, N. Sugar-sweetened beverages and weight gain in children and adults: A systematic review from 2013 to 2015 and a comparison with previous studies. Obes. Facts 2017, 10, 674–693. [CrossRef] [PubMed]
18. Malik, V.S.; Pan, A.; Willett, W.C.; Hu, F.B. Sugar-sweetened beverages and weight gain in children and adults: A systematic review and meta-analysis. Am. J. Clin. Nutr. 2013, 98, 1084–1102. [CrossRef] [PubMed]
19. Malik, V.S.; Schulze, M.B.; Hu, F.B. Intake of sugar-sweetened beverages and weight gain: A systematic review. Am. J. Clin. Nutr. 2006, 84, 274–288. [CrossRef] [PubMed]
20. Mytton, O.T.; Nnoaham, K.; Eyles, H.; Scarborough, P.; Mhurchu, C.N. Systematic review and meta-analysis of the effect of increased vegetable and fruit consumption on body weight and energy intake. BMC Public Health 2014, 14, 886. [CrossRef] [PubMed]
21. Pérez-Escamilla, R.; Obbagy, J.E.; Altman, J.M.; Essery, E.V.; McGrane, M.M.; Wong, Y.P.; Spahn, J.M.; Williams, C.L. Dietary energy density and body weight in adults and children: A systematic review. J. Acad. Nutr. Diet. 2012, 112, 671–684. [CrossRef]
22. Pol, K.; Christensen, R.; Bartels, E.M.; Raben, A.; Tetens, I.; Kristensen, M. Whole grain and body weight changes in apparently healthy adults: A systematic review and meta-analysis of randomized controlled studies. *Am. J. Clin. Nutr.* 2013, 98, 872–884. [CrossRef]

23. Rosenheck, R. Fast food consumption and increased caloric intake: A systematic review of a trajectory towards weight gain and obesity risk. *Obes. Rev.* 2008, 9, 535–547. [CrossRef] [PubMed]

24. Rouhani, M.H.; Haigh, R.; Surkan, P.J.; Azadbakht, L. Associations between dietary energy density and obesity: A systematic review and meta-analysis of observational studies. *Nutrition* 2016, 32, 1037–1047. [CrossRef] [PubMed]

25. Lombard, C.; Martinez-González, M.A.; Bes-Rastrello, M. Alcohol consumption and body weight: A systematic review. *Nutr. Rev.* 2011, 69, 419–431. [CrossRef] [PubMed]

26. Lombard, C.; Martinez-González, M.A.; Ruiz-Canela, M.; Bes-Rastrello, M. Associations between yogurt consumption and weight gain and risk of obesity and metabolic syndrome: A systematic review. *Adv. Nutr.* 2017, 8, 1465–1485. [CrossRef] [PubMed]

27. Schlesinger, S.; Neuenschwander, M.; Schwedhelm, C.; Hoffmann, G.; Bechthold, A.; Boeing, H.; Schwinschakl, L. Food groups and risk of overweight, obesity, and weight gain: A systematic review and dose-response meta-analysis of prospective studies. *Adv. Nutr.* 2019, 10, 205–218. [CrossRef]

28. Schwinschakl, L.; Hoffmann, G.; Kalle-Uhlmann, T.; Arregui, M.; Buijsse, B.; Boeing, H. Fruit and vegetable consumption and changes in anthropometric variables in adult populations: A systematic review and meta-analysis of prospective cohort studies. *PLoS ONE* 2015, 10, e0140846. [CrossRef]

29. Schwinschakl, L.; Hoffmann, G.; Schwedhelm, C.; Kalle-Uhlmann, T.; Missbach, B.; Knüppel, S.; Boeing, H. Consumption of dairy products in relation to changes in anthropometric variables in adult populations: A systematic review and meta-analysis of cohort studies. *PLoS ONE* 2016, 11, e0157461. [CrossRef]

30. Te Moreno, L.; Mallard, S.; Mann, J. Dietary sugars and body weight: Systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ* 2013, 346, e7492. [CrossRef]

31. Seifu, C.N.; Fahey, P.P.; Hailemariam, T.G.; Frost, S.A.; Atlantis, E. Dietary patterns associated with obesity outcomes in adults: An umbrella review of systematic reviews. *Public Health Nutr.* 2021, 1–49. [CrossRef] [PubMed]

32. Fogelholm, M.; Kukkonen-Harjula, K. Does physical activity prevent weight gain—A systematic review. *Obes. Rev.* 2000, 1, 95–111. [CrossRef] [PubMed]

33. Jakicic, J.M.; Powell, K.E.; Campbell, W.W.; DiPietro, L.; Pate, R.R.; Pescatello, L.S.; Collins, K.A.; Bloodgood, B.; Piercy, K.L.; Physical Activity Guidelines Advisory Committee. Physical activity and the prevention of weight gain in adults: A systematic review. *Med. Sci. Sports Exerc.* 2019, 51, 1262. [CrossRef] [PubMed]

34. Hebdon, L.; Chey, T.; Allman-Farinelli, M. Lifestyle intervention for preventing weight gain in young adults: A systematic review and meta-analysis of RCTs. *Obes. Rev.* 2012, 13, 692–710. [CrossRef]

35. Partridge, S.; Juan, S.H.; McGeachan, K.; Bauman, A.; Allman-Farinelli, M. Poor quality of external validity reporting limits generalizability of overweight and/or obesity lifestyle prevention interventions in young adults: A systematic review. *Obes. Rev.* 2015, 16, 13–31. [CrossRef]

36. Ashton, L.M.; Sharkey, T.; Whatnall, M.C.; Haslam, R.L.; Bezzina, A.; Aguier, E.J.; Collins, C.E.; Hutchesson, M.J. Which behaviour change techniques within interventions to prevent weight gain and/or initiate weight loss improve adiposity outcomes in young adults? A systematic review and meta-analysis of randomized controlled trials. *Obes. Rev.* 2020, 21, e13009. [CrossRef]

37. Lombard, C.B.; Deeks, A.A.; Teede, H.J. A systematic review of interventions aimed at the prevention of weight gain in adults. *Obes. Rev.* 2009, 12, 2236–2246. [CrossRef]

38. Hardeman, W.; Griffin, S.; Johnston, M.; Kinmonth, A.L.; Wareham, N.J. Interventions to prevent weight gain: A systematic review of psychological models and behaviour change methods. *Int. J. Obes.* 2000, 24, 131–143. [CrossRef]

39. Martin, J.; Awoke, M.A.; Misso, M.; Moran, L.J.; Harrison, C.L. Preventing weight gain in adults: A systematic review and meta-analysis of randomized controlled trials. *Obes. Rev.* 2021, e13280.

40. Luce, J.; Waters, B.; Hickey, R.; Spallek, M.; Gibson, R.; Byles, J.; Dobson, A. Trends in women’s risk factors and chronic conditions: Findings from the Australian Longitudinal Study on Women’s Health. *Women’s Health* 2007, 3, 423–432. [CrossRef] [PubMed]

41. Adams, L.; Brown, W.; Byles, J.; Chojetia, C.; Dobson, A.; Fitzgerald, D.; Hockey, R.; Loxton, D.; Powers, J.; Spallek, M. Women’s Weight: Findings from the Australian Longitudinal Study on Women’s Health; Department of Health and Ageing, Australian Government: Canberra, Australia, 2007.

42. Gomersall, S.; Dobson, A.; Brown, W. Weight gain, overweight, and obesity: Determinants and health outcomes from the Australasian Longitudinal Study on Women’s Health. *Curr. Obes. Rep.* 2014, 3, 46–53. [CrossRef] [PubMed]

43. Ziauddeen, N.; Roderick, P.J.; Macklon, N.S.; Alwan, N.A. The duration of the intervention period in multiparous women and maternal weight gain between pregnancies: Findings from a UK population-based cohort. *Sci. Rep.* 2019, 9, 1–10. [CrossRef]

44. Lombard, C.; Deeks, A.; Jolley, D.; Teede, H.J. Preventing weight gain: The baseline weight related behaviors and delivery of a randomized controlled intervention in community based women. *BMJ Public Health* 2009, 9, 2. [CrossRef] [PubMed]

45. National Research Council; Institute of Medicine. *Weight Gain during Pregnancy: Reexamining the Guidelines*; National Academies Press: Washington, DC, USA, 2010.
46. Goldstein, R.F.; Abell, S.K.; Ranasinha, S.; Misso, M.; Boyle, J.A.; Black, M.H.; Li, N.; Hu, G.; Corrado, F.; Rode, L. Association of gestational weight gain with maternal and infant outcomes: A systematic review and meta-analysis. *JAMA* 2017, 317, 2207–2225. [CrossRef] [PubMed]

47. Gore, S.A.; Brown, D.M.; West, D.S. The role of postpartum weight retention in obesity among women: A review of the evidence. *Ann. Behav. Med.* 2003, 26, 149–159. [CrossRef] [PubMed]

48. Wise, L.A.; Rothman, K.J.; Mikkelsen, E.M.; Sørensen, H.T.; Riis, A.; Hatch, E.E. An internet-based prospective study of body size and time-to-pregnancy. *Hum. Reprod.* 2010, 25, 253–264. [CrossRef]

49. Voerman, E.; Santos, S.; Inskip, H.; Amiano, P.; Barros, H.; Charles, M.-A.; Chatzizisis, L.; Chrousos, G.P.; Corpeleijn, E.; Crozier, S. Association of gestational weight gain with adverse maternal and infant outcomes. *JAMA* 2019, 321, 1702–1715.

50. Godfrey, K.M.; Reynolds, R.M.; Prescott, S.L.; Nyirenda, M.; Jaddoe, V.V.; Eriksson, J.G.; Broeckman, B.F. Influence of maternal obesity on the long-term health of offspring. *Lancet Diabetes Endocrinol.* 2017, 5, 53–64. [CrossRef]

51. Marchi, J.; Berg, M.; Dencker, A.; Lander, E.; Begley, C. Risks associated with obesity in pregnancy, for the mother and baby: A systematic review of reviews. *Obes. Rev.* 2015, 16, 621–638. [CrossRef]

52. Norman, J.E.; Reynolds, R. The consequences of obesity and excess weight gain in pregnancy. *Proc. Nutr. Soc.* 2011, 70, 450–456. [CrossRef]

53. Gaillard, R.; Durmuş, B.; Hofman, A.; Mackenbach, J.P.; Steegers, E.A.; Jaddoe, V.W. Risk factors and outcomes of maternal obesity and excessive weight gain during pregnancy. *Obesity* 2013, 21, 1046–1055. [CrossRef]

54. Berger, H.; Melamed, N.; Davis, B.M.; Hasan, H.; Mawjee, K.; Barrett, J.; McDonald, S.D.; Geary, M.; Ray, J.G. Impact of diabetes, obesity and hypertension on preterm birth: Population-based study. *PLoS ONE* 2020, 15, e0228743. [CrossRef]

55. Linne, Y. Effects of obesity on women’s reproduction and complications during pregnancy. *Obes. Rev.* 2004, 5, 137–143. [CrossRef] [PubMed]

56. Kramer, C.K.; Campbell, S.; Retnakaran, R. Gestational diabetes and the risk of cardiovascular disease in women: A systematic review and meta-analysis. *Diabetologia* 2019, 62, 905–914. [CrossRef]

57. Yu, Y.; Arah, O.A.; Liew, Z.; Cnattingius, S.; Olsen, J.; Sørensen, H.T.; Qin, G.; Li, J. Maternal diabetes during pregnancy and early onset of cardiovascular disease in offspring: Population based cohort study with 40 years of follow-up. *BMJ* 2019, 367, l6398. [CrossRef] [PubMed]

58. Rong, K.; Yu, K.; Han, X.; Szeto, I.M.; Qin, X.; Wang, J.; Ning, Y.; Wang, P.; Ma, D. Pre-pregnancy BMI, gestational weight gain and postpartum weight retention: A meta-analysis of observational studies. *Public Health Nutr.* 2015, 18, 2172–2182. [CrossRef]

59. Nehring, I.; Schmoll, S.; Beyerlein, A.; Hauner, H.; von Kries, R. Gestational weight gain and long-term postpartum weight retention: A meta-analysis. *Am. J. Clin. Nutr.* 2011, 94, 1225–1231. [CrossRef]

60. Ramachenderan, J.; Bradford, J.; McLean, M. Maternal obesity and pregnancy complications: A review. *Aust. N. Z. J. Obstet. Gynaecol.* 2008, 48, 228–235. [CrossRef] [PubMed]

61. Sebire, N.J.; Jolly, M.; Harris, J.; Wadsworth, J.; Joffe, M.; Beard, R.; Regan, L.; Robinson, S. Maternal obesity and pregnancy outcome: A study of 287 213 pregnancies in London. *Int. J. Obes.* 2001, 25, 1175–1182. [CrossRef] [PubMed]

62. Chu, S.Y.; Kim, S.Y.; Lau, J.; Schmid, C.H.; Dietz, P.M.; Callaghan, W.M.; Curtis, K.M. Maternal obesity and risk of stillbirth: A metaanalysis. *Am. J. Obstet. Gynecol.* 2007, 197, 223–228. [CrossRef]

63. Liu, H.; Zhang, C.; Zhang, S.; Wang, L.; Leng, J.; Liu, D.; Fang, H.; Li, W.; Yu, Z.; Yang, X. Prepregnancy body mass index and weight change on postpartum diabetes risk among gestational diabetes women. *Obesity* 2014, 22, 1560–1567. [CrossRef]

64. Linné, Y.; Barkeling, B.; Rössner, S. Natural course of gestational diabetes mellitus: Long term follow up of women in the SPAWN study. *BJOG Int. J. Obstet. Gynaecol.* 2002, 109, 1227–1231. [CrossRef]

65. Gunderson, E.; Murtaugh, M.; Lewis, C.; Quesenberry, C.; West, D.S.; Sidney, S. Excess gains in weight and waist circumference associated with childbearing: The Coronary Artery Risk Development in Young Adults Study (CARDIA). *Int. J. Obes.* 2006, 28, 525–535. [CrossRef]

66. Mamun, A.; Mannan, M.; Dui, S. Gestational weight gain in relation to offspring obesity over the life course: A systematic review and bias-adjusted meta-analysis. *Obes. Rev.* 2014, 15, 338–347. [CrossRef] [PubMed]

67. Heslehurst, N.; Vieira, R.; Akhter, Z.; Bailey, H.; Slack, E.; Ngongah, L.; Pemu, A.; Rankin, J. The association between maternal body mass index and child obesity: A systematic review and meta-analysis. *PLoS Med.* 2019, 16, e1002817. [CrossRef] [PubMed]

68. Gambineri, A.; Conforti, A.; di Nisio, A.; Laudisio, D.; Muscogiuri, G.; Barrea, L.; Savastano, S.; Colao, A. Maternal obesity: Focus on offspring cardiometabolic outcomes. *Int. J. Obes. Surg.* 2020, 10, 27–34. [CrossRef] [PubMed]

69. Hall, K.D.; Kahan, S. Maintenance of lost weight and long-term management of obesity. *Med. Clin.* 2018, 102, 183–197. [CrossRef]

70. Anderson, J.W.; Konz, E.C.; Frederick, R.C.; Wood, C.L. Long-term weight-loss maintenance: A meta-analysis of US studies. *Am. J. Clin. Nutr.* 2001, 74, 579–584. [CrossRef] [PubMed]

71. Cuco, G.; Fernandez-Ballart, J.; Sala, J.; Viladrich, C.; Iranzo, R.; Vila, J.; Arija, V. Dietary patterns and associated lifestyles in preconception, pregnancy and postpartum. *Eur. J. Clin. Nutr.* 2006, 60, 364–371. [CrossRef]

72. Boghossian, N.S.; Yeung, E.H.; Lipsky, L.M.; Poon, A.K.; Albert, P.S. Dietary patterns in association with postpartum weight retention. *Am. J. Clin. Nutr.* 2013, 97, 1388–1395. [CrossRef] [PubMed]

73. Wen, L.M.; Flood, V.M.; Simpson, J.M.; Rissel, C.; Baur, L.A. Dietary behaviours during pregnancy: Findings from first-time mothers in southwest Sydney, Australia. *Int. J. Behav. Nutr. Phys. Act.* 2010, 7, 13. [CrossRef]
74. van der Pligt, P.; Olander, E.K.; Ball, K.; Crawford, D.; Hesketh, K.D.; Teychenne, M.; Campbell, K. Maternal dietary intake and physical activity habits during the postpartum period: Associations with clinician advice in a sample of Australian first time mothers. *BMC Pregnancy Childbirth* 2016, 16, 1–10. [CrossRef]

75. Lee, A.; Muggli, E.; Hailliday, J.; Lewis, S.; Gasparini, E.; Forster, D. What do pregnant women eat, and are they meeting the recommended dietary requirements for pregnancy? *Midwifery* 2018, 67, 70–76. [CrossRef] [PubMed]

76. Blumfield, M.L.; Hure, A.J.; MacDonald-Wicks, L.K.; Patterson, A.J.; Smith, R.; Collins, C.E. Disparities exist between National food group recommendations and the dietary intakes of women. *BMC Women’s Health* 2011, 11, 37. [CrossRef] [PubMed]

77. Cuervo, M.; Sayon-Orea, C.; Santiago, S.; Martinez, J.A. Dietary and health profiles of Spanish women in preconception, pregnancy and lactation. *Nutrients* 2014, 6, 4434–4451. [CrossRef] [PubMed]

78. Amezcua-Prieto, C.; Lardelli-Claret, P.; Olmedo-Requena, R.; Mozaz-Moreno, J.; Bueno-Cavanillas, A.; Jiménez-Moleón, J. Compliance with leisure-time physical activity recommendations in pregnant women. *Acta Obstet. Gynecol. Scand.* 2011, 90, 245–252. [CrossRef] [PubMed]

79. Vamos, C.A.; Sun, H.; Flory, S.B.; DeBate, R.; Daley, E.M.; Thompson, E.; Bleck, J.; Merrell, L. Community Level Predictors of Physical Activity Among Women in the Preconception Period. *Matern. Child Health J.* 2015, 19, 1584–1592. [CrossRef]

80. Sikkellis, G.; Ponsonby, A.; Wells, J.; Pezic, A.; Cochrane, J.; Dwyer, T. Maternal and infant factors associated with neonatal adiposity: Results from the Tasmanian Infant Health Survey (TIHS). *Int. J. Obes.* 2012, 36, 496–504. [CrossRef]

81. Zhou, S.-S.; Zhou, Y. Excess vitamin intake: An unrecognized risk factor for obesity. *Obesity* 2008, 677–684. [CrossRef] [PubMed]

82. Savage, J.S.; Marini, M.; Birch, L.L. Dietary energy density predicts women’s weight change over 6 y. *Am. J. Clin. Nutr.* 2009, 88, 677–684. [CrossRef] [PubMed]

83. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Hutcheson, M.J.; Jensen, M.E.; Collins, C.E. Dietary patterns and 14-y weight gain among Spanish adults. *Obesity* 2008, 16, 1444–1453. [CrossRef] [PubMed]

84. Wang, L.; Lee, I.-M.; Manson, J.E.; Buring, J.E.; Sesso, H.D. Alcohol consumption, weight gain, and risk of becoming overweight. *Am. J. Clin. Nutr.* 2004, 80, 1386–1396. [CrossRef] [PubMed]

85. Wannamethee, S.G.; Field, A.E.; Colditz, G.A.; Rimm, E.B. Alcohol intake and 8-year weight gain in women: A prospective study. *Obesity* 2007, 15, 967–976. [CrossRef] [PubMed]

86. Boggs, D.A.; Palmer, J.R.; Spiegelman, D.; Colditz, G.A.; Stampfer, M.J.; Willett, W.C.; Hu, F.B. Sugar-sweetened beverages, weight gain, and incidence of type 2 diabetes in young and middle-aged women. *JAMA* 2004, 292, 927–934. [CrossRef]

87. French, S.A.; Harnack, L.; Jeffery, R.W. Fast food restaurant use among women in the Pound of Prevention study: Dietary, behavioral and demographic correlates. *Int. J. Obes.* 2000, 24, 1353–1359. [CrossRef] [PubMed]

88. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Pattison, J.; Taylor, R.M.; Collins, C.E. Frequency and variety of usual intakes of healthy foods, fruit, and vegetables predicts lower 6-year weight gain in young women. *Int. J. Obes.* 2004, 28, 1569–1574. [CrossRef] [PubMed]

89. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Taylor, R.M.; Collins, C.E. Frequency and variety of usual intakes of healthy foods, fruit, and vegetables predicts lower 6-year weight gain in young women. *Eur. J. Clin. Nutr.* 2020, 74, 945–952. [CrossRef]

90. Mekary, R.A.; Feskanich, D.; Malspeis, S.; Hu, F.B.; Willett, W.C.; Field, A.E. Physical activity patterns and prevention of weight gain in premenopausal women. *Int. J. Obes.* 2009, 33, 1039–1047. [CrossRef] [PubMed]

91. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Taylor, R.M.; Collins, C.E. Frequency and variety of usual intakes of healthy foods, fruit, and vegetables predicts lower 6-year weight gain in young women. *Eur. J. Clin. Nutr.* 2020, 74, 945–952. [CrossRef]

92. He, K.; Hu, F.; Colditz, G.A.; Stampfer, M.J.; Willett, W.C.; Hu, F.B. Sugar-sweetened beverages, weight gain, and incidence of type 2 diabetes in young and middle-aged women. *JAMA* 2004, 292, 927–934. [CrossRef]

93. French, S.A.; Harnack, L.; Jeffery, R.W. Fast food restaurant use among women in the Pound of Prevention study: Dietary, behavioral and demographic correlates. *Int. J. Obes.* 2000, 24, 1353–1359. [CrossRef] [PubMed]

94. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Pattison, J.; Taylor, R.M.; Collins, C.E. Frequency and variety of usual intakes of healthy foods, fruit, and vegetables predicts lower 6-year weight gain in young women. *Eur. J. Clin. Nutr.* 2020, 74, 945–952. [CrossRef] [PubMed]

95. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Taylor, R.M.; Collins, C.E. Frequency and variety of usual intakes of healthy foods, fruit, and vegetables predicts lower 6-year weight gain in young women. *Eur. J. Clin. Nutr.* 2020, 74, 945–952. [CrossRef] [PubMed]

96. Martin, J.C.; Moran, L.J.; Harrison, C.L. Diet Quality and Its Effect on Weight Gain Prevention in Young Adults: A Narrative Review. *Semin. Reprod. Med.* 2020, 38, 407–413. [PubMed]

97. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Hutcheson, M.J.; Jensen, M.E.; Collins, C.E. Diet quality, measured by fruit and vegetable intake, predicts weight change in young women. *J. Obes.* 2013, 2013, 525161. [CrossRef]

98. Aljadani, H.M.; Patterson, A.; Sibbritt, D.; Taylor, R.M.; Collins, C.E. Frequency and variety of usual intakes of healthy foods, fruit, and vegetables predicts lower 6-year weight gain in young women. *Eur. J. Clin. Nutr.* 2020, 74, 945–952. [CrossRef] [PubMed]

99. Mekary, R.A.; Feskanich, D.; Malspeis, S.; Hu, F.B.; Willett, W.C.; Field, A.E. Physical activity patterns and prevention of weight gain in premenopausal women. *Int. J. Obes.* 2009, 33, 1039–1047. [CrossRef] [PubMed]

100. Lusk, A.C.; Mekary, R.A.; Feskanich, D.; Willett, W.C. Bicycle riding, walking, and weight gain during pregnancy in industrialized countries—A systematic review of observational studies. *J. Perinat. Med.* 2011, 39, 123–129. [CrossRef]
102. Tielemans, M.J.; Garcia, A.H.; Peralta Santos, A.; Bramer, W.M.; Luksa, N.; Luvizotto, M.J.; Moreira, E.; Topi, G.; de Jonge, E.A.; Visser, T.L. Macronutrient composition and gestational weight gain: A systematic review. *Am. J. Clin. Nutr.* 2016, 103, 83–99. [CrossRef]

103. Maslova, E.; Halldorsson, T.I.; Astrup, A.; Olsen, S.F. Dietary protein-to-carbohydrate ratio and added sugar as determinants of excessive gestational weight gain: A prospective cohort study. *BMJ Open* 2015, 5, e005839. [CrossRef] [PubMed]

104. Olafsdottir, A.; Skuladottir, G.; Thorsdottir, I.; Hauksson, A.; Steingrimsdottir, L. Maternal diet in early and late pregnancy in relation to weight gain. *Int. J. Obes.* 2006, 30, 492–499. [CrossRef]

105. Renault, K.M.; Carlsen, E.M.; Nørgaard, K.; Nilas, L.; Pryds, O.; Secher, N.J.; Olsen, S.F.; Halldorsson, T.I. Intake of sweets, snacks and soft drinks predicts weight gain in obese pregnant women: Detailed analysis of the results of a randomised controlled trial. *PLoS ONE* 2015, 10, e0133041. [CrossRef]

106. Uusitalo, U.; Arkkola, T.; Ovaskainen, M.-L.; Kronberg-Kippilä, C.; Kenward, M.G.; Veijola, R.; Simell, O.; Knip, M.; Virtanen, S.M. Unhealthy dietary patterns are associated with weight gain during pregnancy among Finnish women. *Public Health Nutr.* 2009, 12, 2392–2399. [CrossRef] [PubMed]

107. Rohatgi, K.W.; Tinius, R.A.; Cade, W.T.; Steele, E.M.; Cahill, A.G.; Parra, D.C. Relationships between consumption of ultra-processed foods, gestational weight gain and neonatal outcomes in a sample of US pregnant women. *PeerJ* 2017, 5, e4091. [CrossRef] [PubMed]

108. Wrottesley, S.V.; Pisa, P.T.; Norris, S.A. The influence of maternal dietary patterns on body mass index and gestational weight gain in urban black South African women. *Nutrients* 2017, 9, 7322. [CrossRef] [PubMed]

109. Maugeri, A.; Barchitta, M.; Favara, G.; La Rosa, M.C.; La Mastra, C.; Magnano San Lio, R.; Agodi, A. Maternal dietary patterns are associated with pre-pregnancy body mass index and gestational weight gain: Results from the “mamma & bambino” cohort. *Nutrients* 2019, 11, 1308.

110. Sartorelli, D.S.; Barbieri, P.; Perdonà, G.C. Fried food intake estimated by the multiple source method is associated with gestational weight gain. *Nutr. Res.* 2014, 34, 667–673. [CrossRef]

111. Hirko, K.A.; Comstock, S.S.; Strakovsky, R.S.; Kerver, J.M. Diet during Pregnancy and Gestational Weight Gain in a Michigan Pregnancy Cohort. *Curr. Dev. Nutr.* 2020, 4, nzaa121. [CrossRef] [PubMed]

112. Olson, C.M.; Strawderman, M.S. Modifiable behavioral factors in a biopsychosocial model predict inadequate and excessive gestational weight gain. *J. Am. Diet. Assoc.* 2003, 103, 48–54. [CrossRef] [PubMed]

113. Merkx, A.; Ausems, M.; Budé, L.; de Vries, R.; Nieuwenhuijze, M.J. Weight gain in healthy pregnant women in relation to pre-pregnancy BMI, diet and physical activity. *Midwifery* 2015, 31, 693–701. [PubMed]

114. Shin, D.; Bianchi, L.; Chung, H.; Weatherspoon, L.; Song, W.O. Is gestational weight gain associated with diet quality during pregnancy? *Matern. Child Health J.* 2014, 18, 1433–1443. [CrossRef] [PubMed]

115. Hillesund, E.R.; Bere, E.; Haugen, M.; Øverby, N. Development of a New Nordic Diet score and its association with gestational weight gain. *Eur. J. Clin. Nutr.* 2014, 68, 84–92. [CrossRef]

116. Ebrahimi, F.; Shariff, Z.M.; Tabatabaei, S.Z.; Fathollahi, M.S.; Mun, C.Y.; Nazari, M. Relationship between sociodemographics, dietary intake, and physical activity with gestational weight gain among pregnant women in Rafsanjan City, Iran. *J. Health Popul. Nutr.* 2015, 33, 168.

117. Stuebe, A.M.; Oken, E.; Gillman, M.W. Associations of diet and physical activity during pregnancy with risk for excessive gestational weight gain. *Am. J. Obstet. Gynecol.* 2009, 201, 58.e1–58.e8. [CrossRef] [PubMed]

118. Zulfiqar, T.; Rizvi, F.; Jalali, S.; Shami, S.; Tasnim, N.; Jahan, S. Effects of Maternal Macronutrient intake in 3rd trimester of normal pregnancy on the maternal weight gain and fetal growth—A study performed in the Norwegian Mother and Child Cohort Study (MoBa). *Nutrients* 2021, 13, 2392–2399. [CrossRef] [PubMed]

119. Yong, H.Y.; Mohd Shariff, Z.; Mohd Yusof, B.N.; Rejali, Z.; Tee, Y.Y.S.; Bindels, J.; van der Beek, E.M. Pre-pregnancy BMI influences the association of dietary quality and gestational weight gain: The SECOST Study. *Int. J. Environ. Res. Public Health* 2019, 16, 3735. [CrossRef]

120. Callahan, M.L.; Schneider-Worthington, C.R.; Martin, S.L.; Gower, B.A.; Catalano, P.M.; Chandler-Laney, P. Association of weight status and carbohydrate intake with gestational weight gain. *Clin. Obes.* 2021, e12455. [PubMed]

121. Lagiou, P.; Tamimi, R.; Mucci, L.; Adami, H.; Hsieh, C.; Trichopoulou, A.; Tritsari, V.; Papaconstantinou, A.; Virtanen, S.M. Higher adherence to Mediterranean diet prior to pregnancy is associated with decreased risk for deviation from the maternal recommended gestational weight gain. *Int. J. Food Sci. Nutr.* 2018, 69, 84–92. [CrossRef]

122. Augustin, H.; Winkvist, A.; Bärebring, L. Poor Dietary Quality Is Associated with Low Adherence to Gestational Weight Gain Recommendations among Women in Sweden. *Nutrients* 2020, 12, 317. [CrossRef] [PubMed]

123. Pathirathna, M.L.; Sekijima, K.; Sadakata, M.; Fujiwara, N.; Muramatsu, Y.; Wimalasiri, K. Impact of second trimester maternal dietary intake on gestational weight gain and neonatal birth size. *Eur. J. Clin. Nutr.* 2014, 68, 231–237. [CrossRef] [PubMed]

124. Tielemans, M.J.; Garcia, A.H.; Peralta Santos, A.; Bramer, W.M.; Luksa, N.; Luvizotto, M.J.; Moreira, E.; Topi, G.; de Jonge, E.A.; Visser, T.L. Macronutrient composition and gestational weight gain: A systematic review. *Am. J. Clin. Nutr.* 2016, 103, 83–99. [CrossRef]

125. Augustin, H.; Winkvist, A.; Bärebring, L. Poor Dietary Quality Is Associated with Low Adherence to Gestational Weight Gain Recommendations among Women in Sweden. *Nutrients* 2020, 12, 317. [CrossRef] [PubMed]

126. Sauvé, Z.; Moran, L.J.; Dodd, J.M. Physical activity levels during pregnancy and gestational weight gain among women who are overweight or obese. *Health Promot. J. Aust.* 2014, 24, 206–213. [CrossRef]
127. Yong, H.Y.; Mohd Shariff, Z.; Koo, S.J.; Binti Sa’ari, N.S. Pre-pregnancy body mass index, height and physical activity are associated with rate of gestational weight gain among Malaysian mothers. J. Obstet. Gynaecol. Res. 2016, 42, 1094–1101. [CrossRef] [PubMed]

128. Ehrlich, S.F.; Sternfeld, B.; Krefman, A.E.; Hedderson, M.M.; Brown, S.D.; Mevi, A.; Chasan-Taber, L.; Quesenberry, C.P.; Ferrara, A. Moderate and vigorous intensity exercise during pregnancy and gestational weight gain in women with gestational diabetes. Matern. Child Health J. 2016, 20, 1247–1257. [CrossRef] [PubMed]

129. Haakstad, L.A.; Voldner, N.; Henriksen, T.; Bo, K. Physical activity level and weight gain in a cohort of pregnant Norwegian women. Acta Obstet. Gynecol. Scand. 2007, 86, 559–564. [CrossRef] [PubMed]

130. Harris, S.T.; Liu, J.; Wilcox, S.; Moran, R.; Gallagher, A. Exercise during pregnancy and its association with gestational weight gain. Matern. Child Health J. 2015, 19, 528–537. [CrossRef]

131. Jiang, H.; Qian, X.; Li, M.; Lynn, H.; Fan, Y.; Jiang, H.; He, F.; He, G. Can physical activity reduce excessive gestational weight gain? Findings from a Chinese urban pregnant women cohort study. Int. J. Behav. Nutr. Phys. Act. 2012, 9, 1–7. [CrossRef]

132. Haakstad, L.A.; Voldner, N.; Henriksen, T.; Bø, K. Physical activity level and weight gain in a cohort of pregnant Norwegian women. Acta Obstet. Gynecol. Scand. 2007, 86, 559–564. [CrossRef] [PubMed]

133. Oken, E.; Taveras, E.M.; Popoola, F.A.; Rich-Edwards, J.W.; Gillman, M.W. Television, walking, and diet: Associations with maternity outcomes. J. Clin. Med. 2017, 17, 2021. [CrossRef] [PubMed]

134. Most, J.; Altazan, A.D.; St. Amant, M.; Beyl, R.A.; Ravussin, E.; Redman, L.M. Increased energy intake after pregnancy determines postpartum weight retention at 1-year among women with GDM pregnancy. Matern. Child Health J. 2017, 21, 2527–2538. [CrossRef]

135. Deierlein, A.L.; Siega-Riz, A.M.; Herring, A. Dietary energy density but not glycemic load is associated with gestational weight gain. J. Nutr. 2018, 148, 1830–1841. [CrossRef]

136. Stephenson, J.; Heslehurst, N.; Hall, J.; Schoenaker, D.A.; Hutchinson, J.; Cade, J.E.; Poston, L.; Barrett, G.; Crozier, S.R.; Barker, M. Challenges of Postpartum Lifestyle Interventions. J. Clin. Med. 2019, 8, 1075. [CrossRef] [PubMed]

137. de Castro, M.B.T.; Kac, G.; de Leon, A.P.; Sichieri, R. High-protein diet promotes a moderate postpartum weight loss in a prospective cohort of Brazilian women. J. Clin. Med. 2020, 9, 1891. [CrossRef] [PubMed]

138. Most, J.; Altazan, A.D.; St. Amant, M.; Beyl, R.A.; Ravussin, E.; Redman, L.M. Increased energy intake after pregnancy determines postpartum weight retention among urban Malaysian mothers: A prospective cohort study. J. Obstet. Gynaecol. Res. 2020, 46, 1105. [CrossRef] [PubMed]

139. Stephenson, J.; Heslehurst, N.; Hall, J.; Schoenaker, D.A.; Hutchinson, J.; Cade, J.E.; Poston, L.; Barrett, G.; Crozier, S.R.; Barker, M. Before the beginning: Nutrition and lifestyle in the preconception period and its importance for future health. Lancet 2018, 391, 1830–1841. [CrossRef]

140. Østbye, T.; Peterson, B.L.; Krause, K.M.; Swamy, G.K.; Lovelady, C.A. Predictors of postpartum weight retention among overweight and obese women: Results from the first baby study. BMC Obes. 2017, 4, 31. [CrossRef] [PubMed]

141. de Castro, M.B.T.; Kac, G.; de Leon, A.P.; Sichieri, R. High-protein diet promotes a moderate postpartum weight loss in a prospective cohort of Brazilian women. J. Clin. Med. 2020, 9, 1891. [CrossRef] [PubMed]

142. DiPietro, L.; Evenson, K.R.; Bloodgood, B.; Sprov, K.; Troiano, R.P.; Piercy, K.L.; Vaux-Bjerke, A.; Powell, K.E. Benefits of physical activity during pregnancy and postpartum: An umbrella review. Med. Sci. Sports Exerc. 2019, 51, 1292. [CrossRef] [PubMed]

143. St. Amant, M.; Beyl, R.A.; Ravussin, E.; Redman, L.M. Increased energy intake after pregnancy determines postpartum weight retention among overweight and obese women. Matern. Child Health J. 2015, 19, 528–537. [CrossRef]

144. Jackson, B.S.; Garrard, D.; Herring, A.; Siega-Riz, A.M. Dietary energy density but not glycemic load is associated with gestational weight gain. J. Nutr. 2018, 148, 1830–1841. [CrossRef]

145. Kraschnewski, J.L.; Chuang, C.H.; Downs, D.S.; Weisman, C.S.; McCamant, E.L.; Baptiste-Roberts, K.; Zhu, J.; Kjerulff, K.H. Association of prenatal physical activity and gestational weight gain: Results from the first baby study. Women’s Health Issues 2013, 23, e233–e238. [CrossRef]

146. Kraschnewski, J.L.; Chuang, C.H.; Downs, D.S.; Weisman, C.S.; McCamant, E.L.; Baptiste-Roberts, K.; Zhu, J.; Kjerulff, K.H. Association of prenatal physical activity and gestational weight gain: Results from the first baby study. Women’s Health Issues 2013, 23, e233–e238. [CrossRef]

147. Fadzil, F.; Shamsuddin, K.; Puteh, S.E.W.; Tamil, A.M.; Ahmad, S.; Hayi, N.S.A.; Samad, A.A.; Ismail, R.; Shauki, N.I.A. Predictors of postpartum weight retention among urban Malaysian mothers: A prospective cohort study. Am. J. Clin. Nutr. 2019, 105, 1891. [CrossRef] [PubMed]

148. Fowles, E.R.; Walker, L.O. Correlates of dietary quality and weight retention in women. J. Community Health Nurs. 2006, 23, 183–197. [CrossRef]

149. Stephenson, J.; Heslehurst, N.; Hall, J.; Schoenaker, D.A.; Hutchinson, J.; Cade, J.E.; Poston, L.; Barrett, G.; Crozier, S.R.; Barker, M. Challenges of Postpartum Lifestyle Interventions. J. Clin. Med. 2019, 8, 1075. [CrossRef] [PubMed]

150. Ha, A.V.; Zhao, Y.; Binns, C.W.; Pham, N.M.; Nguyen, P.T.H.; Nguyen, C.L.; Chu, T.K.; Lee, A.H. Postpartum Physical Activity and Weight Retention within One Year: A Prospective Cohort Study in Vietnam. Int. J. Environ. Res. Public Health 2020, 17, 1105. [CrossRef] [PubMed]

151. Chang, M.-W.; Brown, R.; Nitzke, S. Results and lessons learned from a prevention of weight gain program for low-income overweight and obese young mothers: Mothers in motion. BMC Public Health 2017, 17, 182. [CrossRef]
152. Metzgar, C.J.; Nickols-Richardson, S.M. Effects of nutrition education on weight gain prevention: A randomized controlled trial. *Nutr. J.* 2015, 13, 31. [CrossRef]

153. Levine, M.D.; Kleem, M.L.; Kalarchian, M.A.; Wing, R.R.; Weisfled, L.; Qin, L.; Marcus, M.D. Weight gain prevention among women. *Obesity* 2007, 15, 1267–1277. [CrossRef]

154. Bennett, G.G.; Foley, P.; Levine, E.; Whiteley, J.; Askew, S.; Steinberg, D.M.; Batch, B.; Greeney, M.L.; Miranda, H.; Wroth, T.H. Behavioral treatment for weight gain prevention among black women in primary care practice: A randomized clinical trial. *JAMA Intern. Med.* 2013, 173, 1770–1777. [CrossRef]

155. Lombard, C.; Harrison, C.; Kozića, S.; Zoungas, S.; Ranasinha, S.; Teede, H. Preventing weight gain in women in rural communities: A cluster randomised controlled trial. *PloS Med.* 2016, 13, e1001941. [CrossRef]

156. Lombard, C.; Deeks, A.; Jolley, D.; Ball, K.; Teede, H. A low intensity, community based lifestyle programme to prevent weight gain in women with young children: Cluster randomised controlled trial. *BMJ* 2010, 341, c3215. [CrossRef]

157. Choi, J.; Fukuoka, Y.; Lee, J.H. The effects of physical activity and physical activity plus diet interventions on body weight in overweight or obese women who are pregnant or in postpartum: A systematic review and analysis of randomized controlled trials. *Prev. Med.* 2013, 56, 351–364. [CrossRef]

158. Flynn, A.C.; Dalrymple, K.; Barr, S.; Poston, L.; Goff, L.M.; Rogozińska, E.; van Poppel, M.N.; Rayanagoudar, G.; Yeo, S.; Barakat Carballo, R. Dietary interventions in overweight and obese pregnant women: A systematic review of the content, delivery, and outcomes of randomised controlled trials. *Nutr. Rev.* 2016, 74, 312–328. [CrossRef]

159. Hill, B.; Skouteris, H.; Fuller-Tyszkiewicz, M. Interventions designed to limit gestational weight gain: A systematic review of theory and meta-analysis of intervention components. *Obes. Rev.* 2013, 14, 435–450. [CrossRef]

160. O’Brien, C.M.; Grivell, R.M.; Dodd, J.M. Systematic review of antenatal dietary and lifestyle interventions in women with a normal body mass index. *Acta Obstet. Gynecol. Scand.* 2016, 95, 259–269. [CrossRef] [PubMed]

161. The International Weight Management in Pregnancy Collaborative Group. Effect of diet and physical activity based interventions in pregnancy on gestational weight gain and pregnancy outcomes: Meta-analysis of individual participant data from randomised trials. *BMJ* 2017, 358, j3119.

162. Shieh, C.; Cullen, D.L.; Pike, C.; Pressler, S.J. Intervention strategies for preventing excessive gestational weight gain: Systematic review and meta-analysis. *Obes. Rev.* 2018, 19, 1093–1109. [CrossRef] [PubMed]

163. Tanentsapf, I.; Heitmann, B.L.; Adegboyere, A.R. Systematic review of clinical trials on dietary interventions to prevent excessive weight gain during pregnancy among normal weight, overweight and obese women. *BMJ Pregnancy Childbirth* 2011, 11, 81. [CrossRef] [PubMed]

164. Thangaratnam, S.; Rogozińska, E.; Jolly, K.; Glinkowski, S.; Roseboom, T.; Tomlinson, J.; Kunz, R.; Mol, B.; Coomarasamy, A.; Khan, K.S. Effects of interventions in pregnancy on maternal weight and obstetric outcomes: Meta-analysis of randomised controlled trials. *BMJ* 2012, 344, e2088. [CrossRef] [PubMed]

165. Clifton, R.G.; Evans, M.; Cahill, A.G.; Franks, P.W.; Gallagher, D.; Phelan, S.; Pomeroy, J.; Redman, L.M.; Van Horn, L.; Group, L.M.R. Design of lifestyle intervention trials to prevent excessive gestational weight gain in women with overweight or obesity. *Obesity* 2016, 24, 305–313. [CrossRef]

166. Peaceman, A.M.; Clifton, R.G.; Phelan, S.; Gallagher, D.; Evans, M.; Redman, L.M.; Knowler, W.C.; Joshipura, K.; Haire-Joshu, D.; Yanovski, S.Z. Lifestyle interventions limit gestational weight gain in women with overweight or obesity: LIFE-Moms prospective Meta-Analysis. *Obesity* 2018, 26, 1396–1404. [CrossRef] [PubMed]

167. Farpour-Lambert, N.J.; Ells, L.J.; Martinez de Tejada, B.; Scott, C. Obesity and weight gain in pregnancy and postpartum: An evidence review of lifestyle interventions to inform maternal and child health policies. *Front. Endocrinol.* 2018, 9, 546. [CrossRef]

168. Bancroft, M.; Dombrowski, S.U.; Colbourn, T.; Fall, C.H.; Kriznik, N.M.; Lawrence, W.T.; Norris, S.A.; Ngaiza, G.; Patel, D.; Skordis-Worrall, J. Intervention strategies to improve nutrition and health behaviours before conception. *Lancet* 2018, 391, 1853–1864. [CrossRef]

169. Bearak, J.; Popinchalk, A.; Alkema, L.; Sedgh, G. Global, regional, and subregional trends in unintended pregnancy and its outcomes from 1990 to 2014: Estimates from a Bayesian hierarchical model. *Lancet Glob. Health* 2018, 6, e380–e389. [CrossRef]

170. Kandel, P.; Lim, S.; Pirota, S.; Skouteris, H.; Moran, L.J.; Hill, B. Enablers and barriers to women’s lifestyle behaviour change during the preconception period: A systematic review. *Obes. Rev.* 2021. [CrossRef] [PubMed]

171. Adegboyere, A.R.A.; Linne, Y.M. Diet or exercise, or both, for weight reduction in women after childbirth. *Cochrane Database Syst. Rev.* 2013. [CrossRef]

172. Lim, S.; O’Reilly, S.; Behrens, H.; Skinner, T.; Ellis, I.; Dunbar, J. Effective strategies for weight loss in post-partum women: A systematic review and meta-analysis. *Obes. Rev.* 2015, 16, 972–987. [CrossRef] [PubMed]

173. Nascimento, S.; Pudwell, J.; Surita, F.; Adamo, K.; Smith, G. The effect of physical exercise strategies on weight loss in postpartum women: A systematic review and meta-analysis. *Int. J. Obes.* 2014, 38, 626–635. [CrossRef]

174. Elliott-Sale, K.; Barnett, C.; Sale, C. Exercise interventions for weight management during pregnancy and up to 1 year postpartum among normal weight, overweight and obese women: A systematic review and meta-analysis. *Br. J. Sports Med.* 2015, 49, 1336–1342. [CrossRef]

175. Ferguson, J.A.; Daley, A.J.; Parretti, H.M. Behavioural weight management interventions for postnatal women: A systematic review of systematic reviews of randomized controlled trials. *Obes. Rev.* 2019, 20, 829–841. [CrossRef] [PubMed]
176. Van der Pligt, P.; Willcox, J.; Hesketh, K.; Ball, K.; Wilkinson, S.; Crawford, D.; Campbell, K. Systematic review of lifestyle 
interventions to limit postpartum weight retention: Implications for future opportunities to prevent maternal overweight and 
obesity following childbirth. *Obes. Rev.* 2013, 14, 792–805. [CrossRef] [PubMed]

177. Lee, Y.Q.; Loh, J.; Ang, R.S.E.; Chong, M.F.-F. Tracking of Maternal Diet from Pregnancy to Postpregnancy: A Systematic Review 
of Observational Studies. *Curr. Dev. Nutr.* 2020, 4, nzaa118. [CrossRef] [PubMed]

178. Saligeh, M.; McNamara, B.; Rooney, R. Perceived barriers and enablers of physical activity in postpartum women: A qualitative 
approach. *BMC Pregnancy Childbirth* 2016, 16, 131. [CrossRef]