Does the intake of Vitamin B12 in community-dwelling elderly vary by socio-economic status?

An article-based master thesis

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Abstract

Background: Previous studies have found that low socioeconomic status populations, especially older adults, are at higher risk of not meeting the Dietary Reference Intake for vitamin B12. Vitamin B12 malnutrition in older adults is associated with severe neurological complications if not diagnosed early. There is shortage of research on vitamin B12 deficiency in the elderly due to malnutrition, particularly regarding community-dwelling adults.

Objectives: to study whether the intake of vitamin B12 differed among community-dwelling older adults according to education level as a proxy for socioeconomic status; to investigate whether the level of education is associated with dietary vitamin B12 intake; and to determine whether the association between the level of education and vitamin B12 intake differ by age and sex.
The main aim of the systematic review is to summarize the current evidence whether the vitamin B12 intake (including supplements) in community-dwelling older adults varies by socioeconomic factors (i.e., education level and income). The systematic review can be found in Appendix I.

Methodology: The study employed a cross-sectional design of the dietary habits of elderly people over 60 who live in their own homes and spent time in selected senior centers in Oslo. The dietary habits were collected through a standardized food frequency questionnaire (FFQ). T-test for independent samples, Fisher's exact test for categorical data and linear regression model (simple regression, multiple linear regression, and stratified analysis) were used to analyze the data.

Results: Recommended dietary intake for vitamin B12 was met in both, low and high educational groups. No significant association was found between vitamin B12 and education level among older adults ($p > 0.05$). Direction and strength of beta in the regression analysis indicated a tendency towards a positive association of education and higher vitamin B12 intake.

Conclusion: The studies examined and included in the systematic review found that both education and income were positively associated with vitamin B12 intake in community-dwelling older people. This tendency was also observed in the present quantitative study. The number of participants in future studies should be promoted to increase the power regarding differences across educational groups.

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Abbreviations

AI .... Adequate Intake
BCAT .... Basic Cognitive Aptitude Tests
BMI .... Body-Mass-Index
Cbl .... Cobalamin
CI .... Confidence Interval
D-A-CH .... Cross-National Collaboration of Germany, Austria and Switzerland
DNA .... Deoxyribonucleic Acid
DRI .... Dietary Reference Intake
EFSA .... European Food Safety Authority
FAO .... The Food and Agriculture Organization of the United Nations
FFQ .... Food Frequency Questionnaire
HCY .... Homocysteine
IF .... Intrinsic Factor
IoM .... Institute of Medicine
KJ/d .... Kilojoules a day
KORA .... Cooperative Health Research in the Region of Augsburg Age Study
MCV .... Mean Corpuscular Volume
MMA .... Methylmalonic Acid
NCM .... Nordic Council of Ministers
NHANES .... The U.S. National Health and Nutrition Examination Survey
NIH .... National Institutes of Health
NSD .... Norsk senter for forskningsdata
pH .... Potential of Hydrogen
RDA .... Recommended Daily Allowance
RDI .... Recommended Dietary Intake
RI .... Reference Intake
RNI .... Recommended Nutrient Intake
SD .... Standard Deviation
SES .... Socioeconomic Status
Sig .... Significance level
tHcy .... Total Homocysteine
TSD .... Tienester for Sensitive Data at the University of Oslo
WHO .... World Health Organization

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Chapter One: Introduction

This thesis consists of two parts:

1) A systematic review summarizing the differences in vitamin B12 intake in relation to socio-economic status (SES) among community-dwelling elderly aged 60 years and over. Results from the systematic review briefly summarized in chapter “Causes of vitamin B12 deficiency in older adults”, which is found at the end of the introduction chapter. The full systematic review is attached as Appendix I.
2) A quantitative analysis on whether the intake of vitamin B12 differed among community-dwelling older adults in Oslo according to education level, which is summarized in the chapters of this thesis

According to the World Health Organization (WHO) and Statistics Norway, the share of people over 65 in the population will increase significantly in the future (1, 2). Twenty percent of Norwegians will be over 70 years old in 2060, compared with 12 percent today, according to Statistics Norway (2). Meanwhile, the number of people over 80 will triple and those over 90 will quadruple (2).

With advancing age, frailty and physical limitations often increase, as well as concomitant diseases. These circumstances can negatively affect nutritional status, leading to inadequate food intake and potentially malnutrition (3). Although energy requirements often decrease with age because of reduced muscle mass and low physical activity, the need for vitamins and minerals may increase as a result of reduced absorption capacity, for example, due to the use of medications (1).

Malnutrition, particularly in the elderly, is known to be the underlying factor for many diseases and poor health outcomes (4). While there are sufficient studies on malnutrition in elderly whose health has led to assisted living, there is a lack of evidence among older people who are healthy enough to live independently in their own homes (3).

Furthermore, several studies have identified a correlation between low socioeconomic status and lower intakes of various micronutrients (5-7). The U.S. National Health and Nutrition Examination Survey (NHANES) found that low socioeconomic status populations are at higher risk of not meeting the Dietary Reference Intake (DRI) for several nutrients, including vitamin B12 (8).

Vitamin B12 must be supplied through the diet because it is synthesized exclusively by microorganisms in the gut of animals (9-11). For humans, animal products such as meat, fish, eggs, and dairy products are the only sources of vitamin B12 (12).

According to National Institute of Health (NIH) of the U.S. Department of Health and Human Services (2020), nutritional deficiencies are listed as one of the most common causes of vitamin B12 deficiency in the population. It has been found that low educational level and income are associated with malnutrition and poor quality nutrition in older adults (13-16). Especially, older adults with low socioeconomic status (SES) may have a lower intake of micronutrients in comparison to older adults with higher SES (16).

1.1 Literature Review

1.1.1 Nutrition in older age

The nutritional requirements of older adults are similar to those of younger people. Older adults usually need fewer calories as the energy requirement decreases due to reduced muscle mass and lower physical activity. However, the need for most of the micronutrients remains unchanged or can even increase e.g. due to intake of medications (17, 18).

High quality nutrition is a key element to promote health-related quality of life in the elderly as nutrition-related health conditions like diabetes increase with age (19, 20). Nutrition is influenced by a highly individual constellation of physiological, psychological, economic, and social changes in older age which can lead to insufficient food intake and possibly to malnutrition (3, 19, 21). Those changes can include chewing or swallowing problems, lower appetite, a lower income in older age and the home life situation e.g. living independently (22). According to Hickson, the prevalence rate for malnutrition in hospitalized elderly rises by 29-61% compared to the general population (11-44%) (23).

1.1.2 Dietary surveys in older adults

Malnutrition among older hospitalized adults and older adults living in assisted living centers has been well-studied; however, there is a lack of knowledge on the nutritional status of community-dwelling older adults, who live independently in their own homes (3). Physical and mental limitations of older adults can adversely affect the ability to recall and accurately record dietary intake (24). In this context older adults may be incapable to participate in the studies and thus introducing selection bias or underreport intake due to cognitive decline (24).

Dietary assessment methods should be adapted based on the target population and the purpose of the study (25, 26). Food frequency questionnaire (FFQ) are the most used dietary assessment method in studies, as they are low-priced and can be carried out with many participants simultaneously. On the other hand, for a 24-hour dietary recall interviews must be conducted with each participant. Both FFQs and 24-hour recall are objective methods and largely depend on the participants memory (27).

FFQs or 24-hour dietary recalls might be the best technique for older people who are capable to memorize and respond correctly. To reduce the burden for compromised elderly adapted techniques, e.g. objective observation by trained Staff, might be the better approach (25). The main challenges according to de Vries, de Groot and van Staveren are to identify compromised older community-dwelling adults, the financial burden, and additional work required for observational studies at the participants household (25).

1.1.3 Intake and function of Vitamin B12

Smith et al. stated that the effect of vitamin B12 was discovered in 1926 (28). They explained that the compound was first discovered as a nutrient, or extrinsic factor by Minot, Murphy and as well by Whipple's research efforts. Minot and Murphy discovered that pernicious anaemia in the human body can be treated or cured by a diet rich in animal liver (29, 30). The term vitamin B12 is summarised by Green as a generic term for the various compounds with the same chemical backbone, the so-called cobalamins (11). With this, Green specifies the definition of vitamin B12 as a special form of the cobalamins, i. e. as cyanocobalamin (11).

The Panel on Dietetic Products, Nutrients and Allergies of the European Food Safety Authority (EFSA) identifies two biochemical reactions in which cobalamin is required as a coenzyme in the human body (31). According to EFSA, vitamin B12 (cobalamin) is essential for methyl group transfer and is thus required by the human organism for Deoxyribonucleic Acid (DNA) synthesis through interaction with folic acid (31). Human cells are unable to divide without sufficient DNA production (31). Consequently, no new cells can form. Clinically, this manifests mainly as anaemia (31).

There is no universal definition upon on understanding of vitamin B12 deficiency. Shipton & Thachil define a deficiency by a serum concentration of less than 148 pmol/l, while the Institute of Medicine (IoM) defines a level below 120-180 pmol/l as the diagnostic criterion for vitamin B12 deficiency (32, 33). The controversy over the critical level at which vitamin B12 is too low can lead to confusion among health professionals and the public and/or patients. A definite diagnosis is more difficult to make. According to Miller et al. the second essential role of cobalamin is as a coenzyme in the formation of fatty acids, which are essential for the lipids in myelin (34). Hence, cobalamin is also involved in the maturation and regeneration of neurons. In addition, Brito et al. in their study that the transmission of nerve signals was improved in individuals with higher levels of cobalamin compared to those with lower levels (35).

1.1.4 Dietary sources and recommended intake of vitamin B12

Cobalamin, or vitamin B12, is synthesised exclusively by microorganisms in the gut of animals and must be supplied through the diet (9-11). The only source of cobalamin for humans are animal products (e.g. meat, fish, eggs and dairy products) (12, 36). The absorption of vitamin B12 by humans requires a protein, the intrinsic factor, produced by specific cells of the stomach. Therefore failure of the absorption process is a common cause leading to vitamin B12 deficiency and can lead to pernicious anaemia (11). Parallel to active absorption, passive absorption of free vitamin B12 occurs by diffusion in the duodenum. This is proportional to the amount of vitamin B12 present (37).

Ströhle, Richter, González-Gross, Neuhäuser-Berthold, Wagner, Leschik Bonnet & Egert report that in 2018 a cross-national collaboration of Germany, Austria and Switzerland (D-A-CH) increased the recommendation for vitamin B12 intake for adults in these countries from 3.0 to 4.0 µg per day (38). Several studies on the biomarker vitamin B12 status were the basis for this. Furthermore, Ströhle et al. describe that the recommended values vary internationally and are cause for discussion among scientists (38).

In the current report, four different health institutions/organizations are tabulated (table 1) and compared with the respective daily food intake recommendations regarding vitamin B12. The Food and Agriculture Organization of the United Nations (FAO) and the IoM recommend a minimum intake of vitamin B12 of 2.4 µg per day for adults over the age of 19 (33, 39). The EFSA suggests a daily intake of 4.0 µg of the vitamin for adults aged 18 and over (31). The Nordic Council of Ministers (NCM), including Norway, recommends half of this amount, 2.0µg per day (40). These different recommendations could lead to people being unclear about whether they are consuming the correct amount or not.

Table 1: Reference values for the intake of vitamin B12 from different nutrition societies

	World Health Organisation (WHO), Food and Agricultural Organisation of the United Nations (FAO)(39)	**European Food Safety Authority (EFSA)(31)**	**Institute of Medicine (IoM)(33)**	**Nordic Council of Ministers (NCM) (40)**
Adults	Adults ≥ 19 years	Adults ≥ 18 years	Adults ≥ 19 years	Adults ≥ 18 years
	RNI[1] vitamin B12= 2.4 µg d−1	AI[2] vitamin B12= 4.0 µg d−1	RDA[3] vitamin B12= 2.4 µg d−1	RI[4] vitamin B12= 2.0 µg d−1
	Based on the amount of vitamin B12 to maintain the body's store	Based on an adequate biomarker status of vitamin B12 in healthy people	Based on the determination of the amount of vitamin B12 needed for maintenance of an adequate erythropoiesis	Based on the determination of the amount of vitamin B12 needed for maintenance of an adequate erythropoiesis

(adapted from Ströhle, A et al., 2019 (38))

Notes: Abbreviations: [1] RNI, recommended nutrient intake; [2] AI, adequate intake; [3] RDA, Recommended daily allowance; [4] RI, reference intake

1.1.5 Symptoms of Vitamin B12 deficiency

Vitamin B12 deficiency can lead to a variety of non-specific symptoms with limited diagnostic value. Clinical signs at an earlier stage may be weakness, fatigue and weight loss (41, 42).

Clarke et al. reports that vitamin B12 deficiency develops over several years (43). Shipton and Thachil mention that the human body stores large amounts of vitamin B12, especially in the liver, which is why it can take up to 10 years for the deficiency to manifest clinically (32). The authors also emphasise that the deficiency can lead to severe irreversible complications if it is not diagnosed early.

According to Herrmann & Obeid the best-known and also latest indicator of vitamin B12 deficiency is megaloblastic anaemia (44). The anaemia caused by vitamin B12 may be masked by a simultaneous iron intake and mistaken for a folate deficiency (45). Reynolds describes the risk of neurological complications due to an additional intake of folic acid in case of existing vitamin B12 deficiency by masking the anaemia (46). Consequently, the IoM has recommended that daily folic acid supplementation should not exceed 1000 µg (33).

A report published by Schneede and Ueland states that the neurological symptoms of vitamin B12 deficiency include: peripheral neuropathy, confusion, dementia and depression (42).

1.1.6 Causes of vitamin B12 deficiency

Herrmann & Obeid distinguish what they consider to be the significant causes of vitamin B12 deficiency into two categories (45). The authors classify the causes in inherited disorders (table 2) and in acquired causes during life (table 3) (45).

Table 2: Hereditary disorders of cobalamin absorption, transport, metabolism or utilization

Defect	**Affected enzyme or step**	**Metabolic abnormalities**	**Therapeutic strategies**
Congenital pernicious anemia (Intrinsic factor deficiency)	Cobalamin absorption	↑HCY[1], ↑MMA[2]	Cobalamin + intrinsic factor
Imerslund-Gräsbeck syndrome	Selective cobalamin malabsorption	Proteinurea, ↑HCY[1], ↑MMA[2]	Cobalamin injection
Transcobalamin II deficiency	Defective transport of cobalamin into the blood stream and into the cells	↑HCY[1], ↑MMA[2]	High doses of systemic cobalamin
Methylmalonic aciduria	Methylmalonyl CoA mutase deficiency (mut^{0}, mut)	↑MMA[2], acidosis	Protein restriction (limiting the amino acids that use the propionate pathway)
Cbl[3] A and Cbl[3] B diseases	Failure to synthesize adenosylcobalamin	↑MMA[2]	Cobalamin injection
Cbl[3] E and Cbl[3] G diseases	Failure to synthesize methylcobalamin	↑tHcy[4], ↓methionine	Cobalamin injection + Betaine
Cbl[3] C and Cbl[3] D diseases	Failure to synthesize adenosylcobalamin and methylcobalamin	↑MMA[2], ↑tHcy[4]	Cobalamin injection + Betaine
Cbl[3] F disease	Failure to release cobalamin from the lysosome	↑MMA[2], ↑tHcy[4]	Cobalamin injections

(adapted from Herrmann & Obeid, 2012 p. 305 (45))

Notes: Abbreviations: [1]HCY, homocysteine; [2]MMA, methylmalonic acid; [3]Cbl, cobalamin; [4]tHcy, total homocysteine,

Table 3: Acquired causes of cobalamin deficiency

Disease or condition	**Mechanism**
Restricted intake	Vegetarians, children of vegetarian mothers, poverty, malnutrition, anorexia nervosa
Increased demands	Bleeding, pregnancy, lactation
Medications Anti H2 receptor Proton pump inhibitors Oral contraceptives	Changing gastrointestinal potential of Hydrogen (pH), interaction with vitamin absorption or metabolism
Pernicious anemia (type A atrophic gastritis)	Anti-intrinsic factor (IF) antibodies
Antiparital cell antibodies	Lack of IF
Type B atrophic gastritis (H. Pylori)	Changing gastrointestinal pH
Other gastrointestinal morbidities Terminal ileal diseases Pancreatic insufficiency Ileal or gastric resection Celiac disease, tropical spree Colitis ulcerosa, Morbus Crohn	Interact with the vitamin absorption

(adapted from Herrmann & Obeid, 2012, p. 307(45))

The NIH lists pernicious anaemia, postoperative malabsorption, and dietary deficiency as the most common causes of vitamin B12 deficiency in the general population (47).

Diagnosis of vitamin B12 deficiency

Vitamin B12 deficiency is one of the suspects, along with folic acid deficiency, when a routine blood count shows an increased mean corpuscular volume (MCV). This reflects the crucial importance of vitamin B12 for cell proliferation and maturation, so that a deficiency leads to larger than average erythrocytes (48). Herrmann & Obeid point out that studies have shown that development of neurological disorders without macrocytosis of erythrocytes has been frequently observed (45). An increased MCV value is therefore not a reliable indication for the diagnosis of cobalamin deficiency (45).

Usually, the diagnosis is confirmed by the total amount of vitamin B12 or cobalamin fractions (such as holo-transcobalamin) in the serum blood (49). The authors also report that measurements of the vitamin B12 metabolites methylmalonic acid (MMA) and homocysteine have been shown to be more reliable for diagnosis. Briani et al. consider an increase in both MMA and homocysteine levels to be a reliable early marker of cobalamin deficiency, even in the presence of normal vitamin B12 concentrations and absence of haematological anomalies (50).

Aslinia & Mazza & Yale, report that both vitamin B12 and folate are required for the conversion of homocysteine to methionine. Only vitamin B12 is required for the metabolism of MMA (48). These metabolites therefore are an important factor in distinguishing between folate and vitamin B12 deficiency. However, the serum vitamin B12 test remains the standard initial diagnostic test because it is cost-effective and widely available. The feasibility of sample preparation for homocysteine and the high cost of the MMA test have prevented its widespread use (51).

Schneede & Ueland suggest different diagnostic strategies depending on clinical symptoms, patient group and cost of the diagnostic marker (42). They also emphasize that vitamin B12 supplementation should be started immediately when the patient shows typical clinical signs, as the costs are low and vitamin B12 has practically no adverse effects.

1.1.7 Vitamin B12 deficiency in older adults

In a population-based cross-sectional analysis of 3511 elderly in the United Kingdom it was found that 5% of the 65–74 years old and 10% of people aged 75 years or greater are vitamin B12 deficient (52). Herrmann & Obeid report that the prevalence of functional vitamin B12 deficiency in people older than 65 is between 10 and 30%, whereas the prevalence in younger people is between 5 and 7% (44). The authors suspect that due to the low recommended dietary intake (RDI) of 2,4 µg /day for vitamin B12 in the elderly, dietary insufficiency could be underestimated (44).

A follow-up study by Conzade et al. based on the Cooperative Health Research in the Region of Augsburg -Age study (KORA) concluded that the prevalence for vitamin B12 deficiency is 27.3% among older adults, aged 65 to 93 (53). Very old persons (age group 85-93) showed a significant higher prevalence of 37.6%. For the follow-up study, a health questionnaire was sent to all eligible participants of the KORA-Age cohort (n = 9197), i.e. those who were still alive and reachable in 2008/2009. Finally, the data of 1079 persons (537 men, 542 women) were evaluated (53). The method description of the study did not indicate whether the residential situation of the participants was taken into account when selecting them.

According to a study by Loikas et al., no specific risk group among the elderly was identified (54). Consequently, the authors recommend routine screening for the population aged 75 years and older in view of the high prevalence in this age group. Schneede & Ueland support this approach, as symptoms such as cognitive impairment or fatigue are wrongly attributed to the normal ageing process (42). In this context, Herrmann and Obeid also recommend a regular routine examination every 2-3 years (44). They also emphasize that the first clinical signs of B12 deficiency are non-specific. Due to the lack of randomised controlled studies, they recommend both diagnostic and therapeutic measures (44).

Cheng et al. conducted an intervention study with 104 participants aged 55 to 94 years (mean age 73.6 years) with high homocysteine levels (55). They excluded participants with pre-existing conditions that affect homocysteine levels and cognitive function, as well as participants who had previously taken B vitamins. To assess participants' cognitive abilities, basic cognitive aptitude tests (BCATs) were conducted. Participants were either assigned to the intervention group or the placebo group. The intervention group received daily oral supplementation of folate, vitamin B6 and vitamin B12 for 14 weeks. After 14 weeks, the intervention group showed a decrease in homocysteine levels and a significant increase in BCAT total score, while the control group showed no significant changes. This study suggests that people with elevated homocysteine levels could improve their cognitive function by supplementing folate, vitamin B6 and vitamin B12.

However, it is not clear from the study whether the observed improvement was due to the combination of the three B vitamins or whether one of the B vitamins contributed to the improvement.

1.1.8 Causes of vitamin B12 deficiency in older adults

The authors Hermann & Obeid state that the deficiency in the elderly is not mainly due to dietary causes, but for example to malabsorption (44). Malabsorption from food due to atrophic gastritis and insufficient production of gastric juice (40-70% of cases) is the most common cause of vitamin B12 deficiency in older adults (56, 57). The release of dietary vitamin B12 from its binding to dietary proteins requires pepsin and an acidic pH (56). The reason for this insufficient acid production is mainly due to inflammatory processes in the gastric mucosa, which develop mainly as a consequence of atrophic gastritis type B with under- and over-acidity and a reduced production of intrinsic factors (58).

Brouwer-Brolsma, Dhonukshe-Rutten, van Wijngaarden, Zwaluw, Velde & de Groot conducted a cross-sectional study using baseline data from the B-PROOF study, a randomised, placebo-controlled, double-blind intervention trial (59). In this study, the correlation between dietary sources of vitamin B12 and vitamin B12 blood levels in 600 Dutch people aged 65 years and older was investigated. It was found that a high intake of dairy products and meat contributed most to higher vitamin B12 concentrations in the blood.

According to Andrès et al., pernicious anaemia is the second most common cause (15%-20%) after malabsorption (>60%) of vitamin B12 deficiency in older adults (37). Pernicious anaemia is an autoimmune disease that destroys the parietal cells of the stomach, resulting in a lack of intrinsic factor, which is necessary for the absorption of vitamin B12. Nutritional deficiency of vitamin B12 in elderly can result from physiological changes e.g., problems in swallowing meat due to the loss of teeth. According to a study performed by Oliveira Martinho, Araújo Tinôco1 and Queiroz Ribeiro1 the reduced ingestion of red meat is the main cause for a dietary vitamin B12 deficiency, followed by a reduced appetite and lower dairy intake due to lactose intolerance (60). Taking medications such as omeprazole and metformin, as well as gastric surgery, can also result in reduced vitamin B12 absorption (50).

A cross-sectional study of Japanese patients with type 2 diabetes was conducted by Sugawara et al. to investigate the effects of metformin use on vitamin B12 status (61). To this end, the authors compared the concentration of homocysteine, vitamin B12, haemoglobin concentration and MCV of subjects treated with metformin (n=122) and an untreated control group (n=63). They concluded the risk of vitamin B12 deficiency with metformin treatment is generally low in the Japanese population, including those aged 70 years and older.

Nevertheless, there is evidence that higher doses of metformin may correlate significantly with serum levels of homocysteine and vitamin B12. The maximum daily dose of metformin in Japan as well as the relatively low sample size were mentioned as weaknesses of the present study. However, the mean duration of metformin use (6.6 years) investigated in this study showed no effect on vitamin B12 or homocysteine related to duration of use. Several previous studies have shown, in contrast to the Japanese study, that treatment with metformin was associated with a decrease in vitamin B12 blood levels (62, 63).

Furthermore, previous studies have found an association between low socio-economic status and lower intakes of various micronutrients ((5, 7, 64). The NHANES from 2003 to 2016 found that low socioeconomic status populations are at higher risk of not meeting the DRI for several nutrients, including vitamin B12 (65).

Education appears to be a particularly important factor associated with nutrient intake as shown in a cross-sectional analysis in France with more than 90,000 participants. The study concluded that education is positively associated with high nutrient intake (66).

Especially, older adults with low SES may have a lower intake of micronutrients (16). As part of this master thesis, a systematic review on the association between SES and B12 intake in community-dwelling older adults was conducted (Appendix I).

A total of seven studies with data from all together 10,251 participants were included in the systematic review. The present quantitative study was included in the systematic review. A positive association between estimated vitamin B12 intake and SES was observed in six studies. Only the quantitative study reported no association. Six out of seven studies assessed B12 intake levels according to education. Of those, five studies found an association between high and middle income and a high vitamin B12 intake. Five studies also included participants with different level of income. Four studies concluded that low income was associated with a low vitamin B12 intake. No consistent results could be found as to which SES indicators had a greater influence on the vitamin B12 intake in older adults. More details can be found in Appendix I.

1.2 Rationale of the Study

The increased aging of society is accompanied by a growing need to remain healthy in old age. Nutrition is an essential part of this and an important element for a better quality of life. The quality of the diet is defined as a varied and balanced diet that provides an adequate intake of nutrients needed for growth, physical activity and a healthy life (26).

Vitamin B12 malnutrition in older adults can result in non-specific symptoms like fatigue, as well as in a wide range of severe hematologic and neurological complications if not diagnosed early (32).

The adequate intake of nutrients can be influenced by both age and SES. The two factors age and SES paired together can increase the risk of micronutrient malnutrition, also called hidden hunger. This is defined by individuals with adequate energy intake and a normal or even high BMI, but insufficient intake of vitamins and minerals. Hidden hunger may be common in older people with low SES (16).

In addition, it is noticeable that many studies on the topic of vitamin B12 deficiency in older people aged 65 years and older lack adequate statistical power. There is shortage of research on vitamin B12 deficiency in the elderly due to malnutrition, particularly regarding community dwelling adults.

The systematic review conducted as part of this master thesis clearly showed that the association between age and/or SES to vitamin B12 deficiency is not widely researched; only six studies were found to fulfill the predefined criteria for inclusion (Appendix I). Due to limited information on the topic, we used already collected data from a dietary survey performed at senior centers in Oslo in analyzing the association between education level and B12 intake in community-dwelling older adults. This master thesis focuses on this quantitative analysis, whereas more details on the systematic review can be found in Appendix I, which is ready to be submitted.

1.3 Objectives

1.3.1 Main aim of the systematic review

The main aim is to summarize the current evidence whether the Vitamin B12 intake (including supplements) in community-dwelling older adults varies by socioeconomic factors (i.e. education level and income) by conducting a systematic review. The systematic review can be found in Appendix I.

1.3.2 Main aim of the study

The main aim of the study was to study whether the intake of vitamin B12 differed among community-dwelling older adults according to education level as a proxy for socioeconomic status.

1.3.3 Objectives of the study

a) Evaluation of collected information from FFQ to assess vitamin B12 intake from diet in older adults.

b) To investigate whether the level of education is associated with dietary vitamin B12 intake.

c) To determine whether the association between the level of education and vitamin B12 intake differ by age and sex.

Chapter Two: Methodology

2.1 Study Population and Design

The present study is a cross-sectional study conducted between November 2019 and January 2020. The author of the present thesis was not involved in the data collection. The data were collected by two former master's students, two researchers (one of them nutritionists) and a retired nurse. The author of this thesis used the secondary data, and received the results of the FFQ in two separate datasets (with and without dietary supplements) included in the statistical software, SPSS.

The study focuses on elderly people over 65 who live in their own homes as part of the study “Study of nutritional intake in community-dwelling older adults in Oslo”. The recruitment of the participants took place in five senior centers in Oslo: Grønland flerkulterelle seniorsenter, Ensjøtunet, Sagene eldersenter, Stovner eldersenter and Vindern eldersenter bo og aktivitethus. These senior centers are a low-threshold, open social offers for elderly people living at home. The centers offer various social services, such as a café, food supply, pedicure, and hairdresser, but leisure time activities are also part of the services. These include play and exercise programmes, courses, and lectures. The centers were selected to represent different districts of Oslo.

In cooperation with the social workers, nutritional pedagogues and the managers of the centres, the visitors (potential participants) were contacted and informed about the purpose of the study, how they could participate in the study (including the formalities and conditions) and what the results would be used for. Participation was voluntary, and participants were aided in completing the questionnaires if necessary.

During the data collection, the designed questionnaire was challenging and exhausting for many participants of the defined target group as the questionnaire was rather long to complete. During the study the age limit was lowered to 60 years to be able to include more participants. It can be summarized that the inclusion criterion consisted of older adults visiting senior centers in Oslo who volunteered to participate in the study. The exclusion criterion were persons living in an assisted nursing facility, and those that felt they were unable to complete the questionnaires even with assistance.

The study employed a cross-sectional design of the dietary habits of adults over 65 years of age (adjusted during data collection to 60 years of age) who spent time in selected senior centers in Oslo but lived in their own homes. The dietary habits were collected through a nutritional questionnaire, a standardized FFQ. Each of the senior centers received a gift voucher for 1000 Norwegian kroner as compensation, and information on study results were communicated back to participants.

2.1.1 Sample size

The calculation of the sample size depends on the research question. For the present research project, the question aimed to calculate the proportion below the recommended dietary intake of vitamin B12 with reasonable accuracy. Therefore, the sample size formula according to Pourhoseingholi, Vahedi and Rahimzadeh for a proportion was considered the most appropriate (67).

This formula is as follows:

$$n = \frac{z^2 \times p \times (1-p)}{d^2}$$

Here "n" indicates the sample size that is to be found out with the formula. “Z” is the corresponding confidence interval (Here the value of 95% is most often taken by researchers). "P" is the estimated prevalence; this should be based on previous studies. The estimation is a difficult task, but an important factor to calculate an adequate sample size. P also has a significant impact on the variable "d", the precision. For “d”, there are not yet sufficient guidelines for its exact determination. However, several authors recommend that 5% should be selected for "d" if the prevalence of the disease relevant to the research was between 10% and 90% in previous studies (67).

As the literature review revealed, the prevalence in previous studies of vitamin B12 deficiency in the elderly over 65 years of age is between 10% and 45%. Following Pourhoseingholi, Vahedi & Rahimzadeh based on the prevalence (more than 10%), a precision value of d=5% is assumed. Using P=10% and P=45% for the prevalence, the following calculation, with a confidence interval of 95%, results (67):

$$n = \frac{1.96^2 x\ 0.10\ x\ 0.9}{0.05^2} = 138$$

$$n = \frac{1.96^2 x\ 0.45\ x\ 0.9}{0.05^2} = 622$$

This means that a minimum sample size between n=138 (for 10%) and n=622 (for 45%) should have been used for the research project.

The accuracy of the results is (co-)determined by the correctly chosen size of the sample. The higher the sample, the higher the power. The influence of randomness and the scatter of the results decrease. In effect modification, the strength of the effect of a variable change when one or more additional variables are added. The strength of the association between an exposure and an outcome changes depending on one or more exposures. (68).

To estimate the effect size of the association between education level and intake of vitamin B12, the Biomath website (69) was used based on the already collected number of 101 participant. The effect size was 1.1 in both the group with food supplements and without.

The higher the assumed effect, i.e., the further away the alternative hypothesis is from the null effect, the higher the power. For example, the probability of overlooking an existing effect with an odds ratio of 1.2 is greater than overlooking an effect with an odds ratio of 2.5 (68).

2.2 Data collection and analyses

Data on the dietary habits of the study participants were collected via a validated FFQ that has been used in many previous surveys (e.g. the Tromsø study)(70). Questionnaires can be found in Appendix II. This included questions about the intake of certain foods and beverages that are common in Norway. The FFQ is intended to ensure the correct average recording of the reported food intake and to correctly include the daily variations into this average. The frequencies are given as a daily, weekly, or monthly mean. For each question, never/rarely is also available as a choice. To indicate the quantity truthfully, the participants were shown pictures with the respective portion sizes. In addition, the questionnaire also covers the intake of both the type and quantity of food supplements. A free text field was available to add foods that were not asked for in the questionnaire. Age, sex, self-reported height and weight were also inquired.

In an additional questionnaire further background information of the participants was inquired (education level, family status, smoker status, self-reported health status, medication, special diet, migration background) (Appendix III).

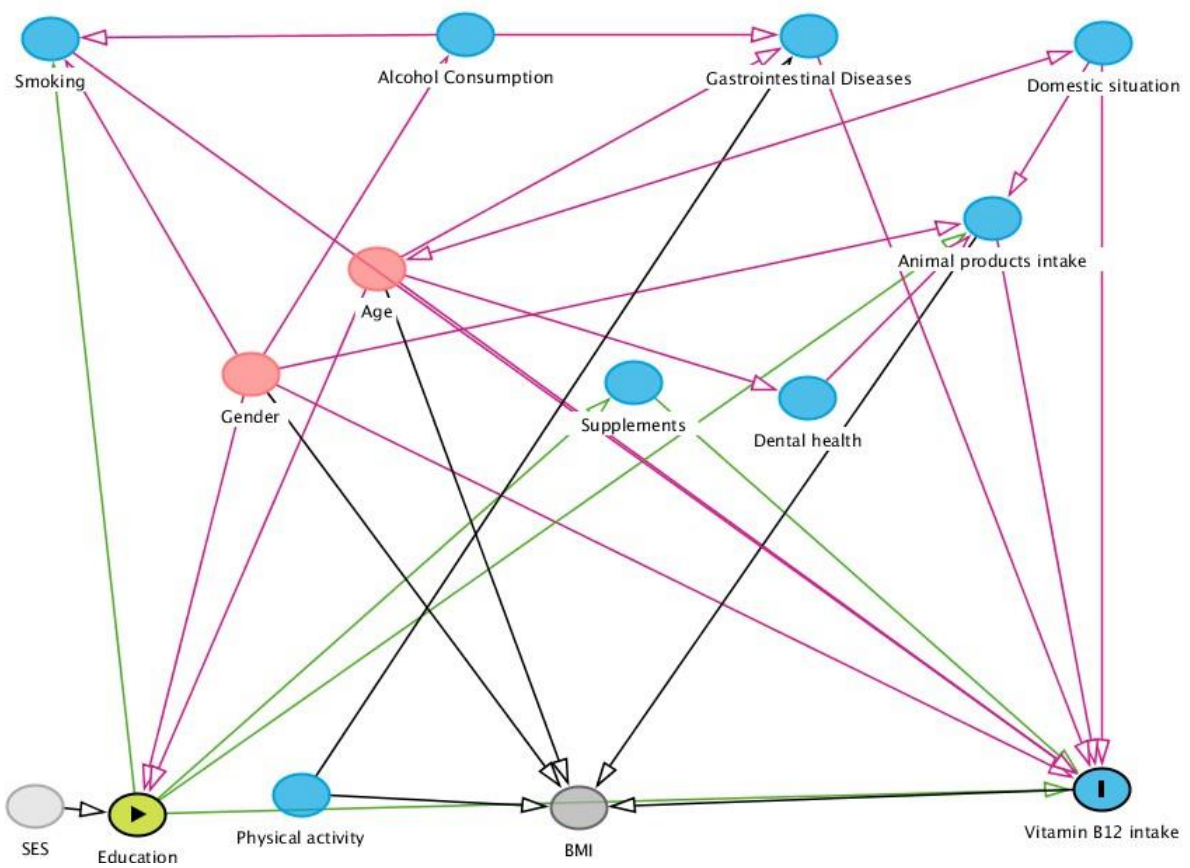
This survey was estimated to take approximately 30-40 minutes to complete. There was also the possibility to receive assistance in filling out the forms, either from the staff at the senior center or from the survey staff and volunteers. If the participants wished, they were also allowed to take the questionnaires home and submit them at a later date, including the consent form for participation.

2.2.1 Data analysis and storage

The nutritional intake in the participants were calculated at the Department of Nutrition at the University of Oslo using the KBS nutrition calculation system. The system calculates the values of energy, nutrients, different vitamins and proteins ingested through food, beverages and food supplements. Intakes were reported with and without supplements included in the calculations, generating two sets of data for each person. The values were given on the appropriate scale of the individual nutrients (e.g., the additional questionnaire was entered into SPSS (version 26) by a project member (a former master student)). All data were stored in Tienester for Sensitive Data at the University of Oslo (TSD), a two-factor authenticated platform for sensitive data storage.

To visualise potential biases in the analysis and avoid them in the conclusion due to different variables, a causal diagram was created using the browser-based directed acyclic graph of exposure-outcome correlations (DAG). Education was the exposure and vitamin B12 intake the outcome factor. The following diagram illustrates the causal diagram created.

Figure 1: Directed Acyclic Graph of the hypothesized-outcome relations



To estimate the total effect, it was necessary to adjust the analyses by the potentially biasing variables age and sex. In total, the following three variables were relevant for the analysis and answering of the research question:

Table 4: Description of the relevant variables

Variable	Scale
Education	Categorical (two groups, low and high)
Sex	Categorical (male and female)
Age	Continuous and Age groups (≤80 and >80)

2.3 Statistical Analysis

The demographic characteristics were listed in a descriptive table. For the continuous variables, age, Body-Mass-Index (BMI), kilojoules a day (KJ/d), the mean (standard deviation, SD) were calculated. The categorical variables, sex, smoking status, living with partner, living children nearby, own health, medication use, special diet, stomach &/or intestinal disease & surgery were reported in proportions. To assess the differences between the means for the continuous variables, the t-test for independent samples was used. For categorical variables, the Fisher exact test was used. Two sets of data were used in the dietary analysis: calculated intake without supplements, and calculated intake with supplements.

An independent samples t-test was used to test whether there was a significant difference between the mean values of the data sets of Vitamin B12 intake without supplements and Vitamin B12 intake with supplements. Furthermore, the calculation was intended to reveal potential differences within the data sets mentioned using the variables education, age, and sex. Education was originally divided into seven groups and was reduced to two groups for this thesis: high: >12 years of education and low: ≤12 years of education. Two categorical groups were formed from the continuous variable age: ≤80 years and >80 years. The sex groups were taken identically from the actual study, into female and male.

Simple regression was used to study the association between education level and dietary vitamin B12 intake without and with supplements included. Multiple linear regression was used to study the association between education and B12 intake after controlling for the influence of sex and age. The analysis (education-B12 association) was also stratified on sex and age to study differences within the groups. Statistical assumptions were checked, and one outlier removed in a sensitivity analysis. SPSS Statistics software version 27 was used for analysis and the significance level was set at 0.05, where $p < 0.05$ indicate statistical significance.

2.4 Ethical Considerations

The project has been approved by the Norwegian Centre for Research Data "Norsk senter for forskningsdata" (NSD). The letter of approval is attached as Appendix VI. Participation in the study was on a voluntary basis and it was possible to withdraw from the study at any time. The participants were informed in advance in written form about participation in the study. Before the start of the data collection, the participants signed an informed consent form (Appendix IV).

Strict data protection measures have been adopted and implemented. The FFQs were provided with anonymous serial numbers, so that traceability to the person is not possible. The data were entered, stored, and analysed in TSD. TSD meets all requirements of Norwegian law regarding safe handling and storing of sensitive data.

Chapter Three: Results

Table 5: Demographic characteristics of older adults in senior centers by education

Characteristics	Lower Education	Higher Education	Total
Age, mean years, (sd)	76.2 (5.456)	78.2 (7.9)	77.8 (7.0)
BMI, mean, (sd)	26.7 (5.57)	24.6 (3.9)	25.3 (4.5)
KJ/d mean (sd)	8069 (3177)	7871 (2137)	
Sex, n (%)			
Female	25 (69.4)	44 (63.8)	69 (69.7)
Male	8 (22.2)	22 (31.9)	30 (30.3)
Smoking			
No, never	21 (61.8)	31 (48.4)	52 (53)
Yes, earlier	9 (26.5)	32 (50)	41 (41.8)
Yes, currently	4 (11.8)	1 (1.6)	5 (5.1)
Living with partner			
No	24 (70.6)	38 (59.4)	62 (64.5)
Yes	10 (29.4)	24 (37.5)	34 (35.4)
Living children nearby			
No	12 (35.3)	15 (23.4)	27 (28.4)
Yes	22 (64.7)	46 (71.9)	68 (71.5)
Own health			
Bad	4 (11.8)	2 (3.1)	6 (6.1)
Not so good	9 (26.5)	15 (23.4)	24 (24.4)
Good	16 (47.1)	34 (53.1)	50 (51)
Very good	5 (14.7)	13 (20.3)	18 (18.3)
Medicine use			
None	5 (14.7)	11 (17.2)	16 (16.3)
1-3	16 (47.1)	36 (56.8)	52 (53)
4 or more	13 (38.2)	17 (26.6)	30 (30.6)
Special diet			
No	28 (82.4)	53 (82.8)	81 (88)
Yes	6 (17.6)	5 (7.8)	11 (11.9)
Stomach &/or intestinal disease & surgery			
No	32 (94.1)	57 (89.1)	89 (96.7)
Yes	2 (5.9)	1 (1.6)	3 (3.2)

3.1 Descriptive characteristics of the sample population

Table five illustrates the frequency distribution of sex (male or female) and descriptive analysis of age variables. Among the total number of participants (101), there were a greater number of female participants (69) than male participants (30). Two participants did not provide information on sex within the education groups. In addition, the mean age of the participants who have lower education is 76.2 years with a standard deviation of 5.5, which is lower than the participants who have higher education with a mean of 78.2 years, and a standard deviation of 7.9. The mean BMI of participants with lower education was 2.1 kg/m² higher than that of participants with higher education. The energy intake per day (KJ/d) was 198 higher in the group of lower educational level than in the group of higher educational level, 8069 KJ/d to 7871 KJ/d. The number of non-smokers and those who have never smoked is 53% overall, 5% currently smoke and 41% used to smoke but have since quit. The number of those who have smoked ever or are currently smokers was higher in the group of the higher educated: 32 participants compared to the participants with a lower level of education with 13 participants. Among participants with low education there was a higher percentage of current smokers: 4% versus 1% in the higher education group. On the family and domestic situation, the survey revealed that 35.4% of the participants live with a partner, which was lower than the participants who did not live with a partner 64.5%. In the group of higher educated participants, the number of those who live with their partner is 25% in relation to the total number of participants, which is about 15% higher than in the group of participants with a lower level of education, where the percentage was 10% of the total number of participants across the education categories.

3.2 Sensitivity analysis: Removing outliers

Table 6: Test of Normality before outliers were removed

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
B12-intake without supplements	.127	99	**.000**	.858	99	.000
B12-intake with supplements	.432	102	**.000**	.115	102	.000
*. This is a lower bound of the estimated significance.						
a. Lilliefors Significance Correction						

The results of the two normality tests, the Kolmogorov-Smirnov test and the Shapiro-Wilk test, are shown in the table 6 "Normality tests before outliers were removed". The variables "B12 intake without supplements" and "B12 intake with supplements" were not normally distributed. If the "sig." value of the Shapiro-Wilk test and the Kolmogorov-Smirnov test is greater than 0.05, the data are normally distributed. If it is less than 0.05, the data are not normally distributed. If it is less than 0.05, the data deviate significantly from a normal distribution (71).

In the Kolmogorov-Smirnov test and the Shapiro-Wilk test, the sig values were smaller than 0.05, so that these two variables were not normally distributed. Visual inspection of the histogram was not bell-shaped, also confirming that the two variables were not normally distributed. Finally, by examining the boxplots of these two variables, one can see that the data set contains one extreme value or outlier. Therefore, the outlier needed to be removed to determine whether the variables are normally distributed or not. The plots are included at the end of this subsection to allow comparison before and after the removal of the extreme outliers.

After removing the outliers and conducting a normality test again, the results shown in the tables below were found:

Table 7: Test of Normality after outliers were removed

Tests of Normality						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
B12-intake without supplements	.092	92	**.053**	.975	92	.069
B12-intake with supplements	.078	95	**.195**	.975	95	.066
*. This is a lower bound of the estimated significance.						
a. Lilliefors Significance Correction						

From table 7 above, the variables "B12 intake without supplements" and "B12 intake with supplements" are normally distributed after removing the outlier. If the significance value (sig.) of the Shapiro-Wilk test and the Kolmogorov-Smirnov test is greater than 0.05, the data are normally distributed. If it is less than 0.05, the data deviate significantly from a normal distribution (71). As for the Kolmogorov-Smirnov test and the Shapiro-Wilk test, our sig values are greater than 0.05, so these two variables are normally distributed. Visual inspection of the histogram also confirms that the histograms are bell-shaped. Finally, from the boxplots of these two variables, there are no more extreme values or outliers in the data set. In a sensitivity analysis, one extreme outlier was removed. The following plots show first the data before the outliers were removed and then the data after the outliers were removed.

Figure 2: Histogram of Vitamin b12 intake without supplements before removing outliers

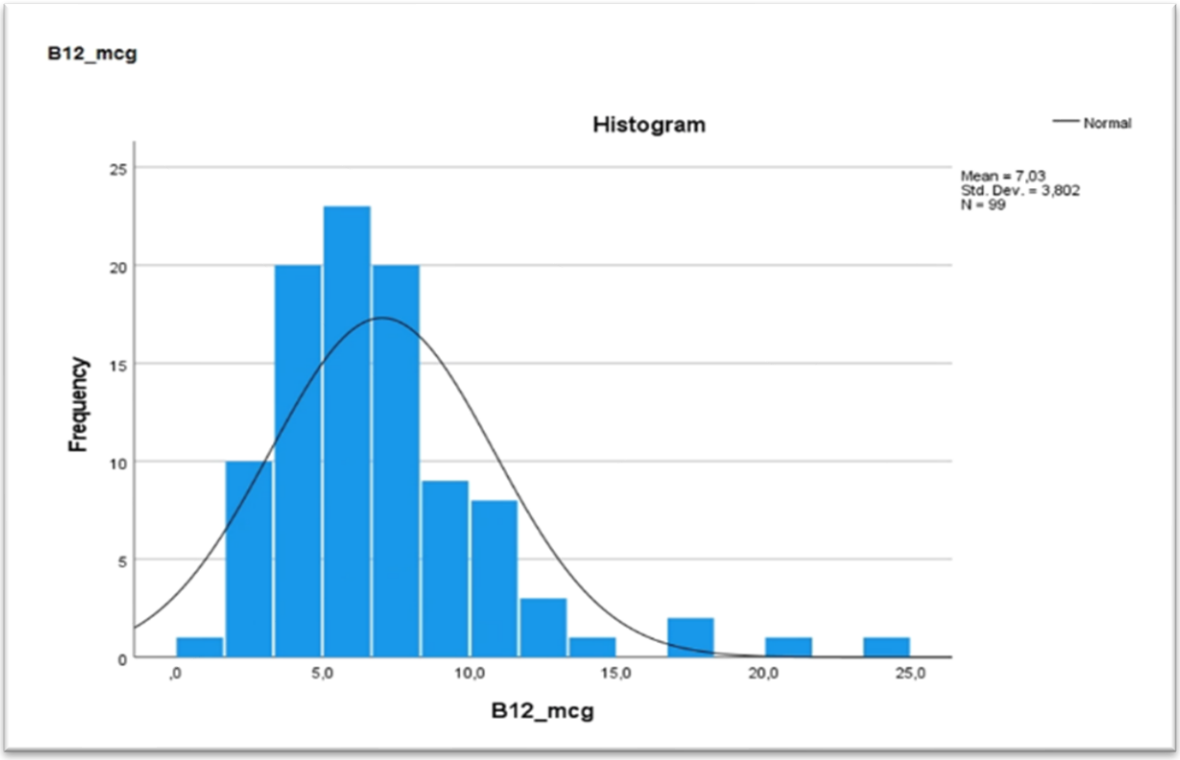


Figure 3: Histogram of Vitamin b12 intake without supplements after removing outliers

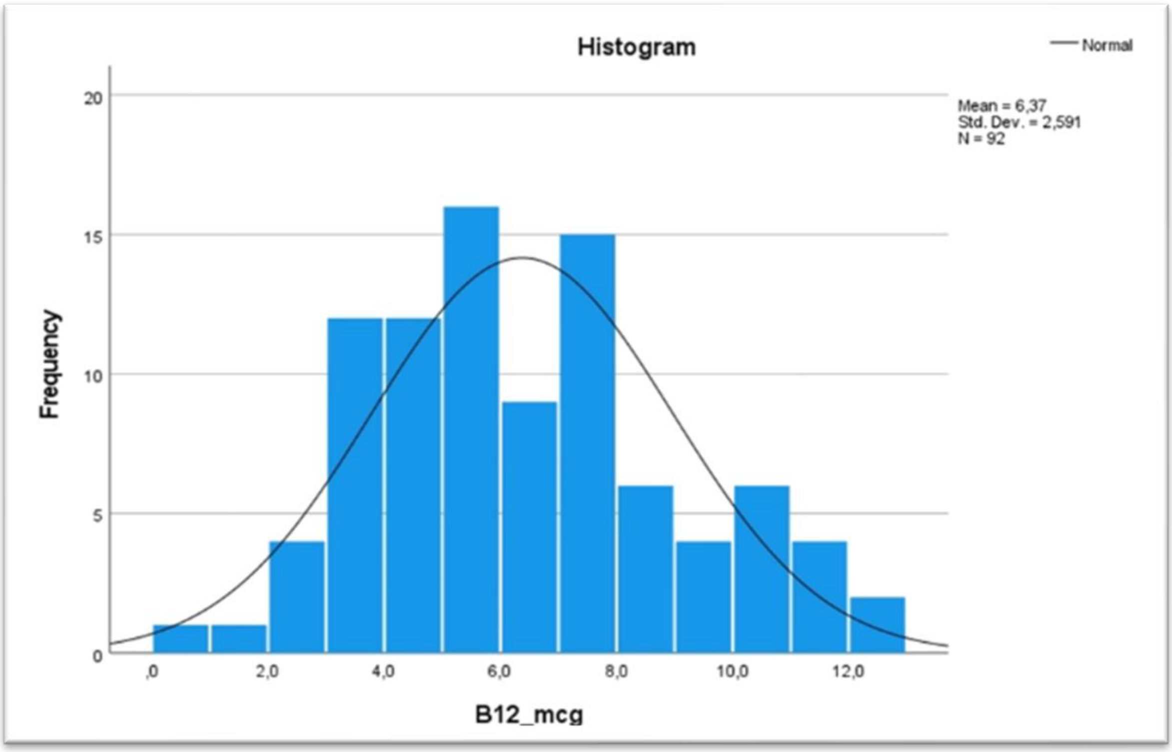


Figure 4: Normal Q-Q Plot of Vitamin b12 intake without supplements before removing outliers

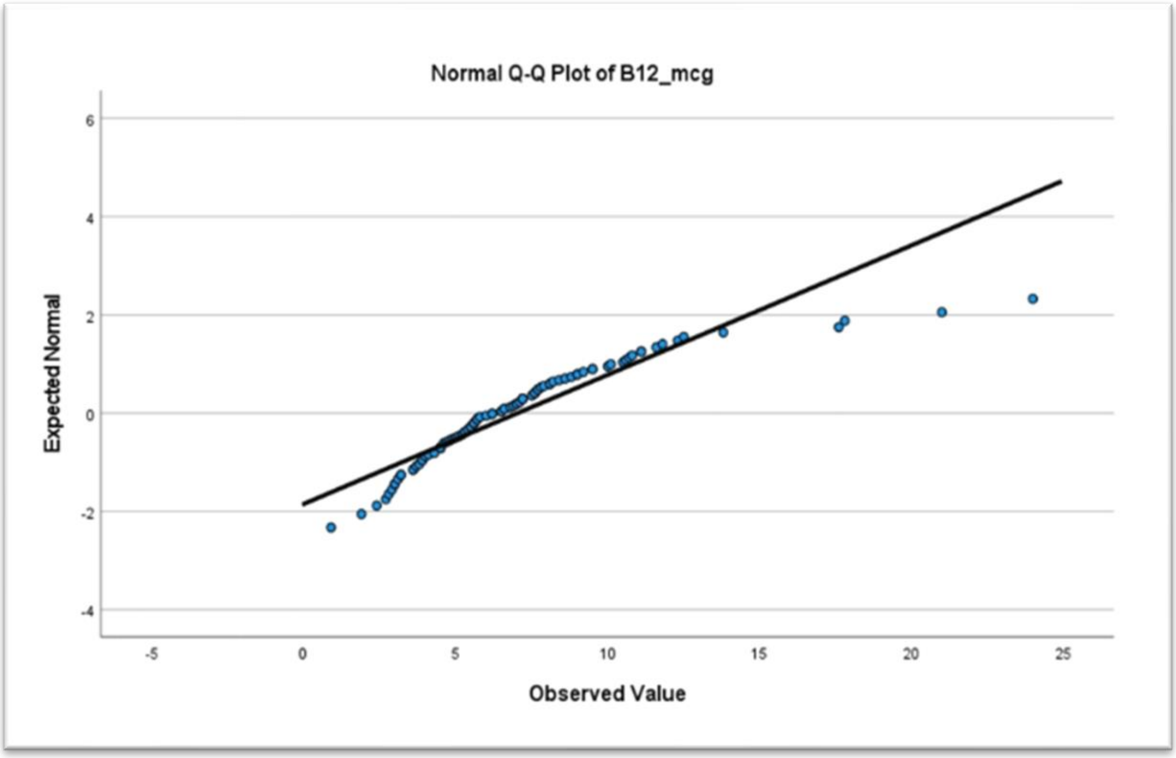


Figure 5: Normal Q-Q Plot of Vitamin b12 intake without supplements after removing outliers

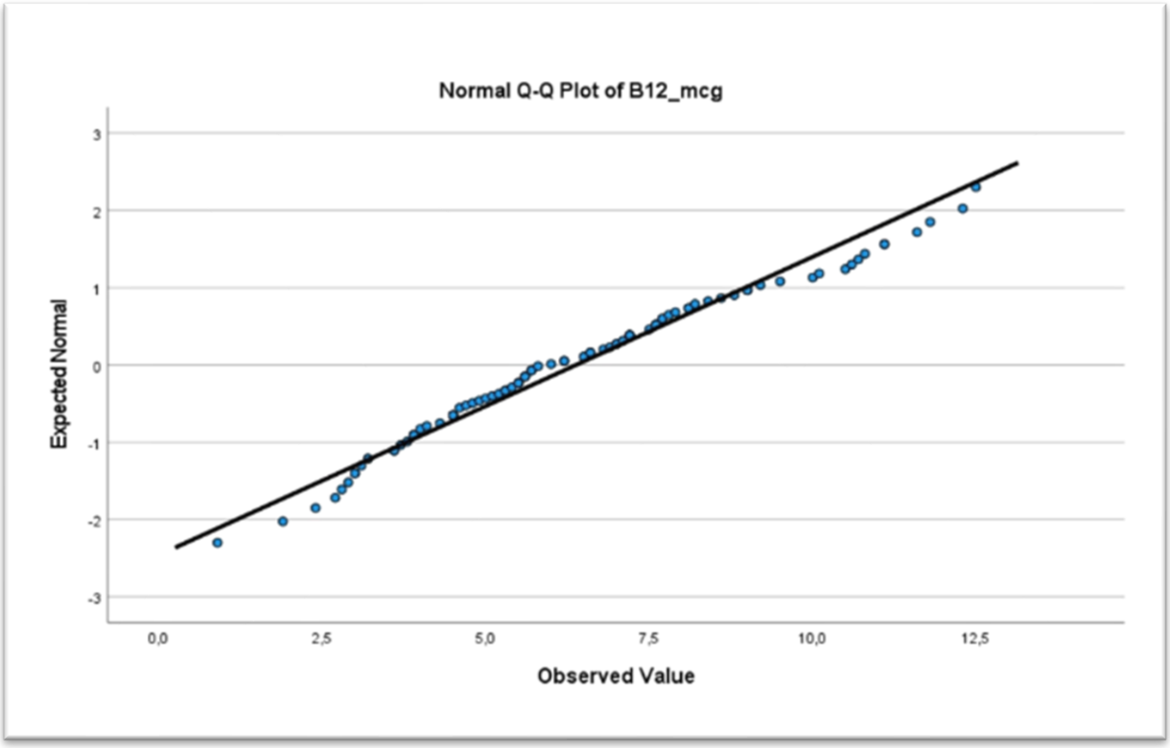


Figure 6: Histogram of Vitamin b12 intake with supplements before removing outliers

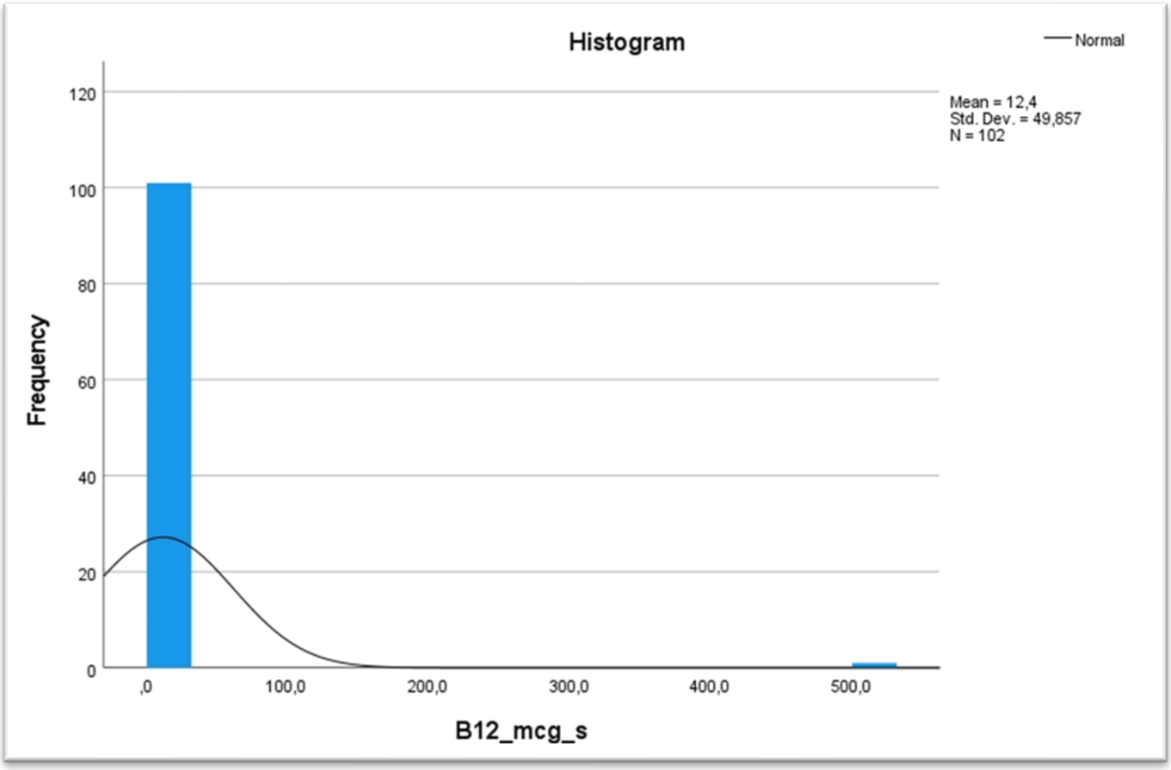


Figure 7: Histogram of Vitamin b12 intake with supplements after removing outliers

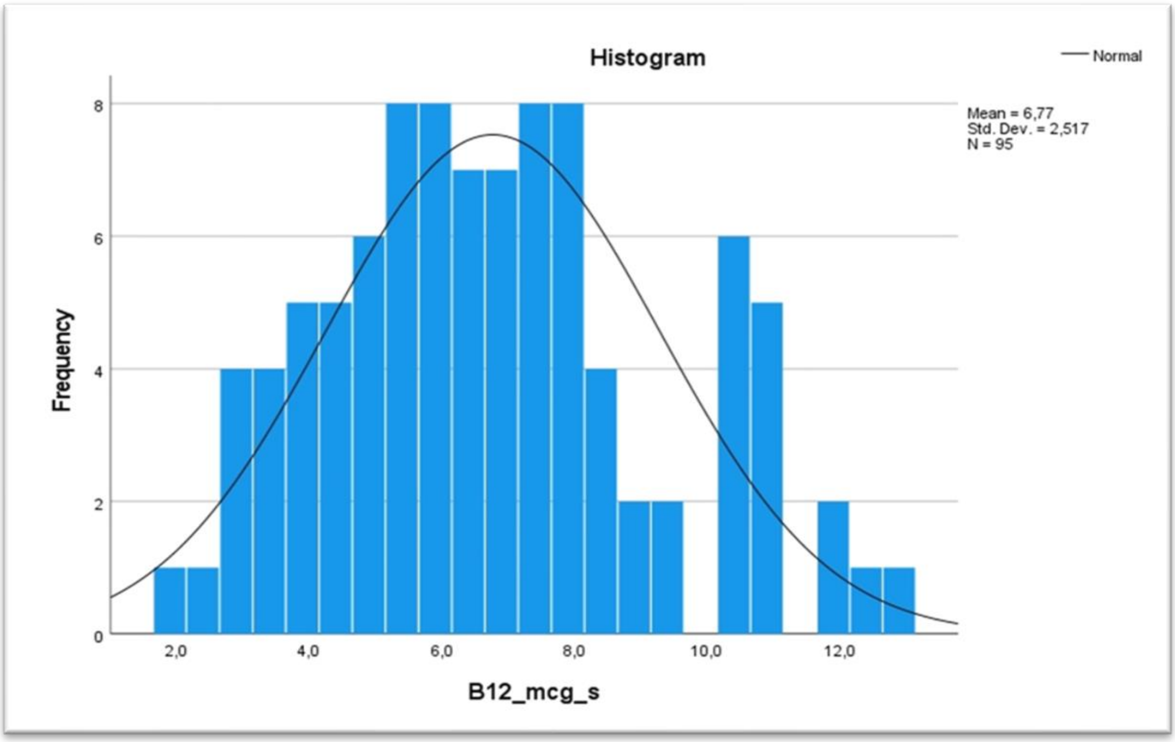


Figure 8: Normal Q-Q Plot of Vitamin b12 intake with supplements before removing outliers

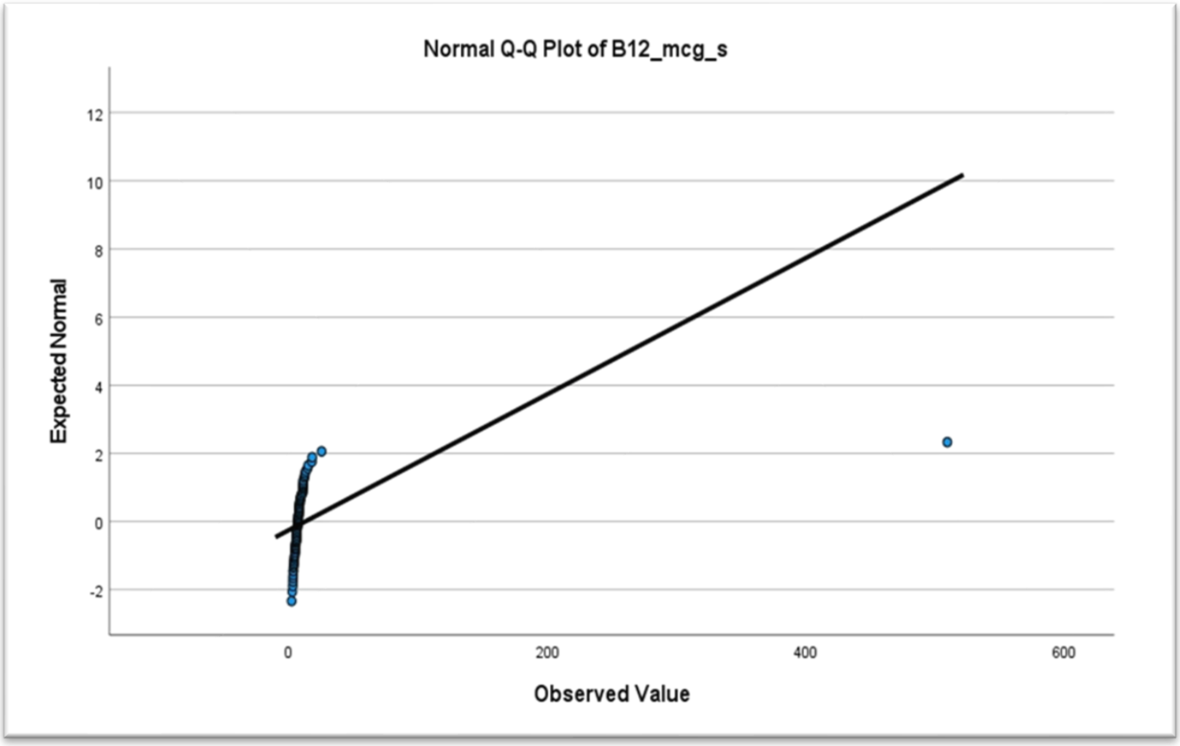
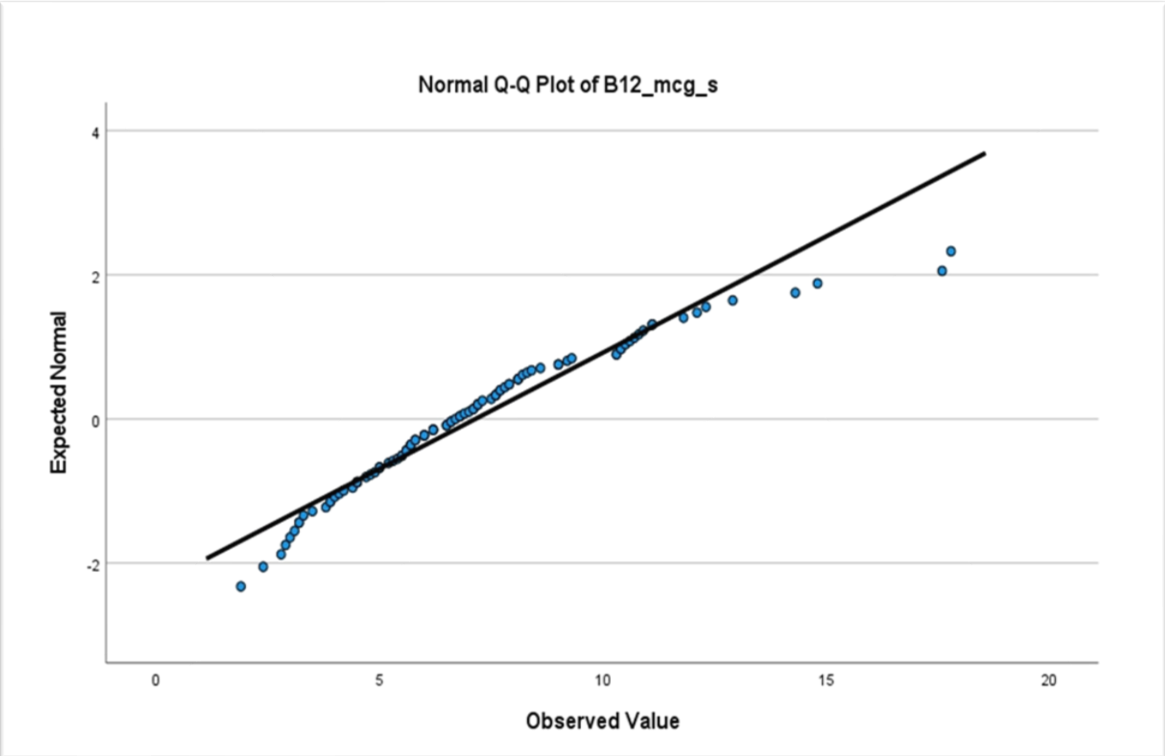


Figure 9: Normal Q-Q Plot of Vitamin b12 intake with supplements after removing outliers



3.3 Result on Vitamin b12 intake in older adults

An independent samples t-test was used to check whether there was a significant difference between the mean values of the data sets of Vitamin B12 intake without supplements and vitamin B12 intake with supplements. The first assumption for the independent sample t-test is the scales of the variables used should be continuous or ordinal/nominal. The scale used for sex, education, and age are nominal/ordinal variables and the scale for B12 intake without supplements and B12 intake with supplements are continuous.

Conducted a normality test prior, the histogram showed the distribution of B12 intake with supplements and without supplements are bell-shaped - normal distribution. B12 intake was calculated without supplements and with supplements. Since the mean intake for B12 without and with supplements were similar to the median intakes, only the means are presented.

Here from Table 6, it can be observed that the total mean of B12 intake without and with supplements were 6.38 µg/d (±2.51) and 6.77 µg/d (±2.51) respectively. Therefore, mean intakes were greater for B12 intake with supplements than B12 intake without supplements, with the same standard deviation.

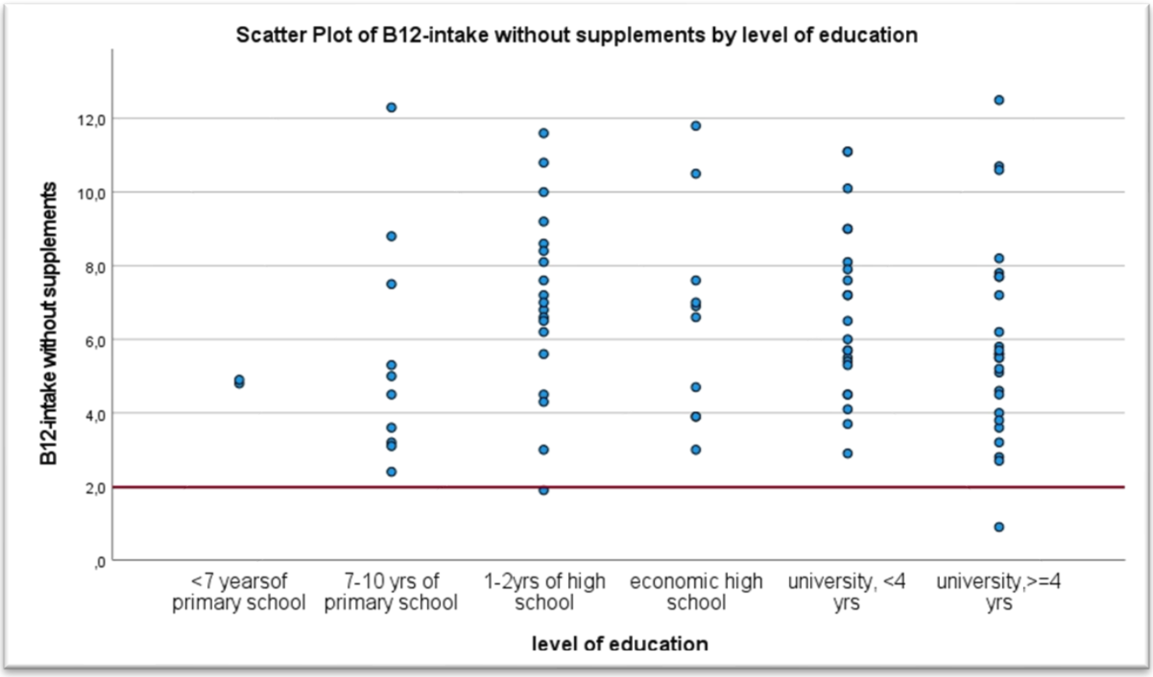
In Table 1, B12 intake with and without supplements are presented based on education level (high and low), age level (≤80 and >80), and sex group (male and female).

Table 8: Mean vitamin B12 intake from diet without and with supplements by sample characteristics in older adults in senior centers in Oslo

Variables	B12 intake without supplements		Variables	B12 intake with supplements	
	Mean, μg/d (sd)	p-value		Mean, μg/d (sd)	p-value
Education			Education		
Lower	6.43 (2.71)	.855	Lower	6.72 (2.78)	
Higher	6.32 (2.56)		Higher	6.77 (2.39)	.932
Total	6.38 (2.51)		Total	6.77 (2.51)	
Age			Age		
≤80	6.69 (2.70)	.113	≤80	7.09 (2.63)	.088
>80	5.79 (2.29)		>80	6.18 (2.21)	
Sex			Sex		
Male	6.39 (2.34)	.813	Male	6.60 (2.18)	.857
Female	6.25 (2.67)		Female	6.71 (2.59)	

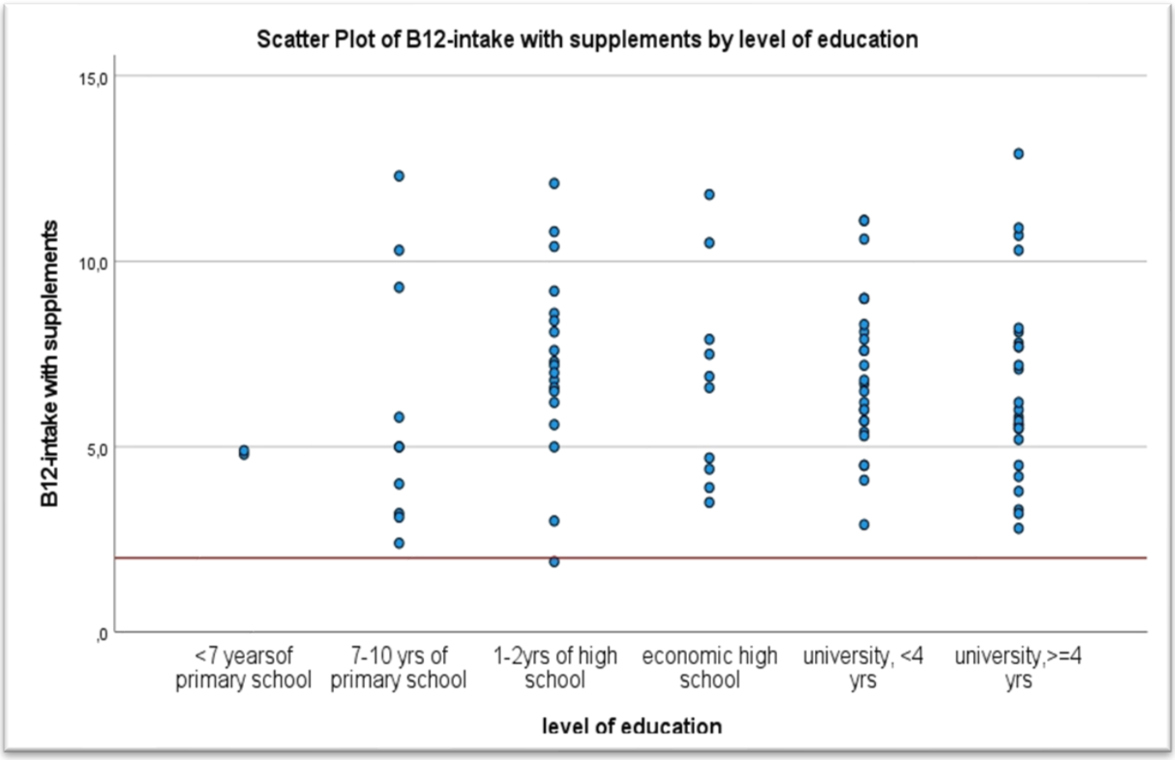
From the overall analysis, the p-value indicates there is no statistically significant difference in B12 intake with supplements with education, age, and sex levels, where p-values were .855, .113, and .813 respectively. For B12 intake without supplements, there are also no statistically significant p-values. That means the difference between B12 intake without supplements with education level (high and low), age level (≤80 and >80), and sex group (male and female) were not statistically significant.

Figure 10: Scatter Plot of B12-intake without supplements by level of education



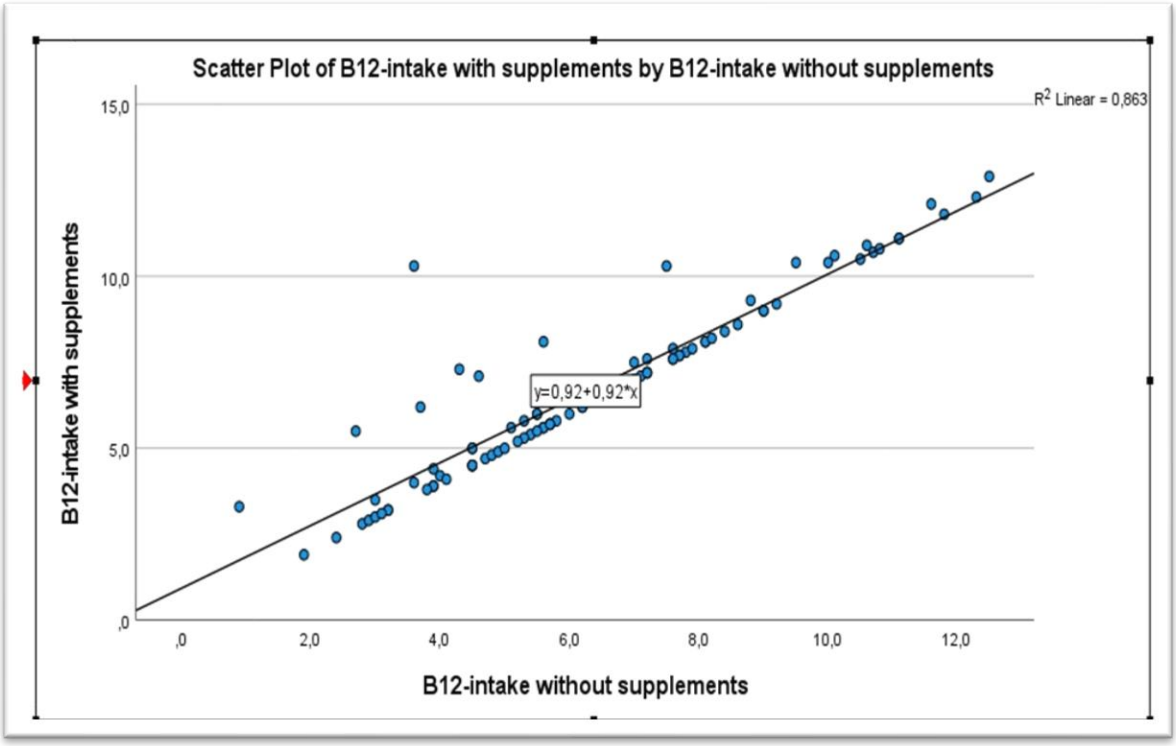
In this scatterplot of vitamin B12 intake without supplements based on the education level of the participants in the study, it is apparent that two participants were below the recommended daily level of 2 µg for Norway.

Figure 11: Scatter Plot of B12-intake with supplements by level of education



In this scatterplot of vitamin B12 intake with food supplements based on the education level of the participants in the study, one participant is below the recommended daily value of 2 micrograms for Norway.

Figure 12: Scatter Plot of B12-intake with supplements by B12-intake without supplements



From that scatter plot observe that there is a very strong positive relationship between vitamin B12 intake with supplements and vitamin B12 intake without supplements. That means if the vitamin B12 intake with supplements increase then the vitamin B12 intake without supplements will also increase and vice-versa, i.e., participants with a high intake from diet also have a high intake when including supplements.

3.4 Regression analysis

3.4.1 Results on association between education level and older adults (simple linear regression) and adjusted for age and sex (multiple linear regression)

Table 9: Vitamin B12 intake and education unadjusted and adjusted for age and sex

	Vitamin b12 intake without supplements				Vitamin b12 intake with supplements			
	B*1	**95% CI Lower Bound***	**95% Upper Bound**	**Sig.**	**β**	**95% CI Lower Bound**	**95% Upper Bound**	**Sig.**
Education[A]	-,107	-1,262	1,049	,855	,048	-1,059	1,154	,932
Education[B]	0,005	-1,173	1,183	,993	,205	-,925	1,334	,720

*The 95% confidence interval (CI) selects, with a probability of 95%, the true (but unknown) value in the population from which the sample originates (population). With a probability of 5%, the true value lies outside this range (68)

*1 The beta coefficient is partial and describes the strength of a correlation, adjusted for the influences of other factors. Beta coefficients are regression coefficients standardized to the respective value range and indicate the importance of the included independent variables (71)

A= Unadjusted

B= Adjusted for age and sex

Simple regression was used to study the association between education level (low=reference) and vitamin B12 intake where education recording a beta value (beta = -.107, $p > .05$). When going from a low to a high level of education the B12 intake without supplements was reduced by -0.1 µg/day. The p-value was >0.05, which means education was not a statistically significant association with vitamin B12 intake without supplements. When adjusting for age and sex (Multiple linear regression) an increase in education level was associated with an increase of .005 µg/day in B12 intake.

Where education recording a beta value (beta = .048, $p > .05$). When going from a low to a high level of education the B12 intake with supplements was increased by 0.048 µg/day. The p-value was >0.05, which means education was not a statistically significant association with vitamin b12 intake with supplements. When adjusting for age and sex (Multiple linear regression) an increase in education level was associated with an increase of .205 µg/day in B12 intake.

3.4.2 Results on association between education level and older adults, stratified on age and sex

Table 10: Vitamin B12 intake and education stratified on age and sex

		Without Supplements			With Supplements		
Age	**n**	**β**	**95% CI Lower Bound***	**95% CI Upper Bound**	**β**	**95% CI Lower Bound**	**95% CI Upper Bound**
≤80	61	-.20	-1.67	1.27	.12	-1.29	1.54
>80	34	.67	-1.38	2.72	.46	-1.48	2.39
Sex							
Male	27	.90	-1.23	3.04	1.00	-1.00	3.00
Female	68	-.50	-1.92	.91	-.28	-1.64	1.08

*The 95% confidence interval (CI) selects, with a probability of 95%, the true (but unknown) value in the population from which the sample originates (population). With a probability of 5%, the true value lies outside this range (68)

*1 The beta coefficient is partial and describes the strength of a correlation, adjusted for the influences of other factors. Beta coefficients are regression coefficients standardized to the respective value range and indicate the importance of the included independent variables (71)

A stratification was conducted i.e. a separate analysis of the education-B12 intake association for the individual subgroups of age and sex to study whether there was an effect modification by age and sex. The stratification by age showed that in the age group ≤80 the daily vitamin B12 intake without supplements decreases by .20 µg/day (beta = -.20; 95% CI -1.67/ 1.27) when going from low to high education. i.e. a negative association between education and vitamin B12 intake. The association was in the opposite direction in the age group ≤80 with supplements. Here the daily vitamin B12 intake increases by .12 µg/day (beta = .12; 95% CI -1.29/1.54) (table 10)

Furthermore, in the age group >80 the daily vitamin B12 intake without supplements increases by .67 µg/day (beta = .67; 95% CI -1.38/ 2.72), i.e. an positive association between education and B12 intake. The association was in the same direction in the age group >80 with supplements. Here the daily vitamin B12 intake increases by .46 µg/day (beta = .46; 95% CI -1.48/ 2.39) (table 10)

The stratification by sex showed that in the male group the daily vitamin B12 intake without supplements increases by .90 µg/day (beta = .90; 95% CI -1.23/3.04), i.e., a positive association between education and vitamin B12 intake. The association was in the same direction in the male group with supplements. Here the daily vitamin B12 intake increases by 1 µg/day (beta= 1; 95% CI -1/3)

In the female group without supplements, however, the daily vitamin B12 intake decreased by .5 µg/day (beta: -.5; CI -1.92/.91). The association was in the same direction in the female group with supplements. Here the daily vitamin B12 intake decreases by .28 µg/day (beta = -.28; 95% CI -1.64/ 1.08 (table 10).

Chapter Four: Discussion

The present study focuses on describing vitamin B12 intake in relation to educational level among community-dwelling older adults in Oslo. Dietary intake both with and without supplements is considered. The average vitamin B12 intake met the official recommendations, in the group with as well as in the group without supplements. In both groups, the intake decreased slightly with age. This study indicated that the education level has no statistical significance on the intake of vitamin B12 in older adults, but the same tendency could be seen towards a positive association of vitamin B12 intake and high education.

4.1 Vitamin B12 Intake

In the study, the mean vitamin B12 intake of the participants was above the recommended daily intake by the NCM, both in the group without supplements and with supplements. However, the mean value decreased with increasing age, but not below the recommended daily value. In the group without food supplements, two participants did not reach the recommended daily intake of vitamin B12, in the group with food supplements one person did not.

Malnutrition in older people is known to be a cause of many diseases and poor health outcomes (4). While energy requirements often decrease in old age due to reduced muscle mass and low physical activity, the need for vitamins and minerals remains unchanged. Indeed, the demand may even increase if the absorption capacity is reduced, e.g. due to the intake of medication (18).

In recent years, the health of older people has improved. Nevertheless, frailty and physical limitations, together with comorbidities, often increase with age (72). These circumstances may negatively affect nutritional status, leading to inadequate food intake and possibly malnutrition (3).

Vitamin B12 is one micronutrient that is essential for maintaining health and must be supplied through the diet. Only microorganisms in the gut synthesize vitamin B12 (9, 11, 73), and the only sources of vitamin B12 for humans are animal products such as meat, fish and dairy products (12).

Vitamin B12 deficiency can lead to a wide range of non-specific symptoms with low diagnostic value. At an earlier stage, clinical signs can present as weakness, fatigue and weight loss (41, 42). In a study performed by Loikas et al., no specific risk group among elderly could be identified (54). The authors, therefore, recommend routine screening for the population aged 75 and upwards in view of the high prevalence in this age group. Schneede & Ueland support this approach as symptoms like cognitive impairment or fatigue are further erroneously attributed to the normal aging process (42).

As previously mentioned, the human body is able to store vitamin B12 for several years and it can take up to 10 years before a B12 deficiency manifests itself (32, 74). This means that it is possible that a deficiency can manifest insidiously while dietary habits remain unchanged. For example, due to undiagnosed diseases that hinder and/or prevent the new intake of vitamin B12.

For the present study, this means that in the case of vitamin B12, a blood test would be appropriate in addition to the FFQ to detect a deficiency caused by the factors mentioned. The overall prevalence of vitamin B12 deficiency in this age group ranged from 2.5% to 30% in the studies for the systematic review (Appendix I). In the present study, the proportion of those who do not consume the recommended daily amount is 0.9% in both the supplement and non-supplement groups.

4.2 Vitamin B12 intake and education

The daily intake of vitamin B12 without supplements is slightly higher in the lower education group than in the higher education group [6.43 µg/d (lower education); 6.32 µg/d (higher education)]. The average daily intake of vitamin B12 with supplements is slightly higher in the higher education group than in the lower education group [6.72 µg/d (lower education); 6.77 µg/d (higher education)].

4.2.1 Comparison with the nationwide Norkost study

This finding is in line with the results of a nationwide dietary study performed between 2010 and 2011 that was also conducted in Norway (Norkost 3)(75). It showed that among the 1,787 participants aged 18 to 70 years, people with a higher level of education consumed a healthier diet than people with a lower level of education. However, no significant difference in vitamin B12 intake was found between the different levels of education (75). The Norkost 3 study was not included in the systematic review as it lacks information on vitamin B12 intake in older adults in connection to their education.

4.2.2 Comparison with studies included in the systematic review (Appendix I)

In the systematic review conducted as part of this thesis, we included six out of seven studies, which assessed B12 intake levels according to education. All studies, except for the present quantitative study, found an association between high and middle income and a high vitamin B12 intake. However, the studies by Bianchetti et al. and by Bates et al. conducted in

Italy and the UK, respectively, showed no significant influence of education on vitamin B12 intake (76, 77).

The study by Mendonca et al., performed in the UK, found that the vitamin B12 intake was slightly lower (3.0 µg /day) at the highest level of education (≥12 years), compared to participants with a medium level of education (3.1 µg /day), but still being higher than for participants with a low educational level (2.8 µg /day) (78).

According to a study conducted in the USA by Agnew-Blais et al., 56.3 % of women in the low education group had a vitamin B12 intake below 2.4 µg/day and 42 % of women had a vitamin B12 intake of ≥2.4 µg/day. In contrast, 22.4 % of women in the high education group had an intake of less than 2.4 µg/day and 30.4 % had a vitamin B12 intake of ≥2.4 µg/day (79).

In a study conducted in Brazil, it was found that vitamin B12 intake in the elderly was significantly higher in the high education group than in the low education group (low education: 4.1 µg/day vs. high education 6.1 µg/day) (80).

The studies conducted in the USA and Brazil showed that education had a more significant influence on vitamin B12 intake than the income whereas the study in Italy came to the opposite conclusion (77, 79, 80).

These results may indicate that the influence of education level on the intake of vitamin B12 may vary regionally.

4.3 Vitamin B12 intake and sex

No significant difference was found in the present study between sex regarding the intake of vitamin B12, with or without supplements. Furthermore, the analysis showed no significant effect of sex on the ratio of education to vitamin B12 intake.

A similar result was also reached in the study by Bianchetti et al., who found a vitamin B12 intake of less than 3 µg/day in the lower educated group, 32.8 % of men and 33.7 % of women. In contrast, only 26.9 % of men and 30.4 % of women in the group with higher education fell below a daily intake of 3 µg/day (77). Income had a greater influence on vitamin B-12 intake in this study, but there were no significant differences between sexes. The percentage of participants in the low-income group who had a vitamin B12 intake of less than 3 µg/day was 35.5 % for men and 37.5 % for women. In contrast, only 25.8% of men and 25.9% of women in the higher income group had a daily intake of less than 3 µg. Consequently, the study found that income had a stronger association with vitamin B12 intake than education, but a significant difference between sexes was not found here either (77).

4.4 Vitamin B12 intake and age

Regarding the influence of age on vitamin B12 intake, there were tendencies in the present study for vitamin B12 intake to decrease with increasing age. In the intake of B12 without food supplements, the age group ≤80 years consumed an average of 6.69 µg/day and those >80 years consumed an average of 5.79 µg/day. When consuming B12 with food supplements, the ≤80 age group consumed an average of 7.09 µg/day and the >80 age group consumed an average of 6.18 µg/day. However, the analyses did not show any significance in the differences and no age group remained below the recommended daily amount.

Malnutrition in older people can be a cause of many diseases and poor health outcomes (4). Frailty and physical limitations together with comorbidities often increase with age (72). These circumstances can negatively affect nutritional status, leading to inadequate food intake and possibly malnutrition (3).

The results of the study indicate that the recommended daily amount of vitamin B12 is relatively easy to cover through the diet, even in advancing age.

4.5 Methodological considerations

4.5.1 Study design

Cross-sectional studies are momentary snapshots and describe the distribution of one exposure, one disease or both at the same time in the population at a specific point in time. They describe the condition of the studied population without being able to reveal a cause-effect relationship. Cross-sectional studies are suitable for developing new hypotheses. However, they are not suitable for testing hypotheses, i.e. for verifying them scientifically (68).

The present study can be seen as a pilot study and for this reason the chosen design of cross-sectional study is appropriate. It is important to know the possibilities and limitations of this type of study and to take them into account when interpreting and drawing conclusions. Based on the results and hypotheses derived from the present study, more specific studies can be conducted.

4.5.2 Precision, power and sample size

The study was planned with a sample size of up to 500 participants. The power calculation in the context of vitamin B12 deficiency resulted in an optimal number of participants of 138 participants (with an assumed prevalence of 10% with B12 deficiency) or 622 participants (with an assumed prevalence of 45% vitamin B12 deficiency) (see chapter 2.2.2). However, it was only possible to recruit 241 participants. In the end, 102 participants completed the FFQ. Among the data on vitamin B12 intake, there was one extreme outlier, which was removed after a sensitivity analysis.

4.5.3 Response rate

The response rate was calculated as follows:

Number of forms received / Number of forms distributed 100%.*

The response rate of the FFQ was 42.3%

4.5.4 Validity

Messick states that validity always refers to the extent to which empirical evidence and theoretical justifications support the reasonableness and appropriateness of interpretations and measures based on test results (81). Heale and Twycross define it as the degree to which a research instrument consistently produces the same findings when used repeatedly in the same setting (82). Essentially, a distinction is made between internal and external validity (83).

4.5.5 Internal Validity

According to Akobeng, a study is considered internally valid if the observed differences between groups of patients assigned to different interventions can be correctly attributed to the intervention under study (83). A lack of internal validity affects the quality of the evidence which can be inferred from a study. As the two main errors that can affect internal validity, the author mentions both bias and random error. For the present study, a validated FFQ that had already been tested in another study was therefore used. The questionnaire included common foods consumed by most of the Norwegian population.

4.5.6 Selection bias

Selection bias refers to an error in the selection of study participants. This means that the people selected for the study differ systematically from the population from which the selection was made (68). Cases and controls must come from the same (sub-) population. If this is not the case, selection error occurs due to inappropriate selection (68). In the present study, more than half of the study participants had a high level of education and this educational group was thus overrepresented compared to the total elderly population of Oslo and could be a possible selection bias.

An essential component of selection bias is the so-called non-response bias. There is a high probability that these non-responders differ from the study participants. Possible reasons include potential participants not being interested in health issues, feeling too old or too ill to complete the questionnaire, or language barriers (68).

The aforementioned difficulty of the questionnaire being too complex or too long and thus too demanding for some potential participants of the selected population was also encountered in the implementation of the present study, which ultimately had an influence on the sample size.

4.5.7 Information bias

Misclassification can occur when individuals are incorrectly categorized due to faulty measurements or inaccurate information. Both exposure status and outcome status can be affected by incorrect categorization. Misclassification due to inaccurate information is called information bias in epidemiology (68). A frequent risk factor for the emergence of information bias is the misinterpretation of the assessment instrument of the study by the study participants, for example through the misunderstanding of a question asked or a memory gap (68). In the case of the present study with the FFQ, the amount of consumption of a certain food in the last few days.

4.5.8 Assessment Tools

A validated FFQ was used for the present study (70). FFQs are a simple and effective means of tracking regular dietary patterns over a period of time (27). However, they are vulnerable to bias, which has already been described in the chapter on selection and information bias. During the data collection for this study, it became apparent that both information and selection bias could pose a risk to the analysis and interpretation of the data. some participants had difficulties remembering the food they had eaten recently or the amount of food they had eaten, or were overwhelmed by the length of the questionnaire, which could lead to a lack of concentration when answering the questions (potential information bias). On the other hand, the size and complexity of the FFQ may have discouraged potential participants from taking part in the study, which may lead to a bias in the results because the final participants of the study do not reflect the entire target group (selection bias).

4.5.9 Confounding

The terms bias and confounding need to be differentiated. Bias are systematic errors that can hardly be corrected retrospectively. In contrast, confounding is based on an error in the interpretation of the data, which can still be recognized afterwards and considered in the data evaluation. However, the prerequisite for this is that the confounder is measured in the study. Typical confounders include sex, age, socio-economic status, tobacco and alcohol consumption (68).

For the analysis of the present thesis, this was considered, first by preparing a DAG, (Figure 1), and the resulting potential confounders were considered in the evaluation and interpretation of the data.

4.5.10 External Validity

Ferguson states that the term 'external validity' is frequently associated and, moreover, used interchangeably with the term 'generalizability' (84). Generalizability is the process of using certain data to make a general statement that is applicable to the intended or the general population, settings or times - in other words, the term refers to the characteristic of being applicable in other situations (84). Furthermore, the author refers to Morgan & Harmon's definition that external validity is a function of both the researcher and the research design (85). Accordingly, this means that generalizability depends on the researcher and the user (85). In this context, it is crucial for the use of the knowledge that the user must determine the relevance of the results to the intended population and whether the results are generalizable to this or other settings and populations (84).

4.5.11 External validity of the current study

For the present study, which was conducted in different senior centers in Oslo, this means that it cannot be applied to the entire Norwegian population as well as to the general elderly population in Norway. The study focused on the community of elderly not living in nursing homes. Highly educated people were overrepresented here. Consequently, the study is only comparable with studies that have taken place in a similar setting. Specifically, studies with similar age groups with similar socio-economic contexts in similar settings.

4.5.12 Strengths and Limitations

The main limitation of the present study is the low sample size. This is also a factor that is difficult to consider when analyzing the data. It is therefore more important to take this fact into account when interpreting the results.

Despite the small number of participants, those who took part provided very detailed data, which is also due to the validated FFQ used. In addition, the FFQ had already been tested in another study (70) with the same population group and proved to be a suitable tool in this context. The fact that nutrient intakes for the sample group were estimated twice (once with and once without supplements) provides useful information on the use of supplements in the selected study population.

A possible selection bias is the fact that mainly healthy and rather fit elderly people participated in the study and thus does not reflect the complete range of elderly people in Oslo. Although participants who were not able to complete the FFQ on their own were assisted by study officials, this can be seen as a strength in the study implementation, as it gave the opportunity to diversify the study participant group. However, due to limited resources and the related effort, this could not be extended to the breadth that would have been necessary to bring the number of participants to the desired level.

It is one of the few studies carried out so far in the context of food intake in community-dwelling older adults, and thus the experience gained in conducting and evaluating the study is an important foundation for subsequent studies with this or similar settings.

Chapter Five: Conclusion

The present thesis examined whether the vitamin B12 intake of older adults varies in relation to education by conducting a systematic review and analyzing data collected by a standardized FFQ from a study performed in Oslo. The studies examined and included in the systematic review found that both education and income were positively associated with vitamin B12 intake in community-dwelling older people. The reasons for this association could not be clarified within the review. A tendency towards this association was also found in the analysis of the data from the study conducted in Oslo. The mean vitamin B12 intake was mostly in line with the official recommendations both in the included studies of the systematic review and in the present study.

Implications: The estimates of the included studies of the systematic review and the present study tend to go in the same direction, an association of the intake of vitamin B12 and the level of education seems to be related. Due to the small number of participants in the present study, the association was not significant. However, this aspect is due to the lack of power of the study. It would be interesting for future studies to determine whether the association could be confirmed as significant with a higher number of participants.

Elderly people belong to the risk group for developing a vitamin B12 deficiency, as was evident in the literature review. As shown in the studies of the systematic review as well as in the present study, the risk of developing this deficiency through insufficient nutrient intake is rather low. These two positions make it clear that a vitamin B12 deficiency can be caused by several factors and should therefore also be checked medically, for example by a blood test if suspected.

Recommendations: Undetected vitamin B12 deficiency can lead to non-specific symptoms as fatigue and severe irreversible neurological complications. However, the amount ingested with food does not necessarily indicate the vitamin B12 status as malabsorption is a frequent and important interacting factor. In addition, atrophic gastritis, pernicious anaemia and the use of medication is especially prevalent in older people. It should therefore be considered to screen the serum for biomarkers of a vitamin B12 deficiency in older adults.

Future research: The participation of, especially very old adults, in dietary surveys should be promoted to increase the power of the studies regarding differences across educational groups. This could be achieved by simplified FFQs or by observational studies. More investigations are needed to identify comorbidities influencing the intake of vitamin B12 in community-dwelling older adults through the diet.

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Appendices

Appendix I: Systematic Review

Does the intake of vitamin B12 in community-dwelling older adults vary by socio-economic status? A systematic review and narrative summary

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Abstract

Purpose The present systematic review aimed to examine the differences in vitamin B12 intake in relation to socio-economic status (SES) among community-dwelling older adults aged 60 years and over.
Methods MEDLINE, Embase, CINAHL, and Scopus, were searched for literature published in English through 11th December 2020 that included assessment of vitamin B12 intake and socio-economic variables (educational level and income) in ≥60-year-old community-dwelling subjects. Titles, abstracts, and full text were screened for eligibility. The quality of the included articles was assessed using the Newcastle-Ottowa Scale (NOS) for cohort and an adapted version for cross-sectional studies.

The study protocol was registered in PROSPERO with the number CRD 42021278349.
Results A total of 7 studies from 5 countries, with data from all together 10,251 participants met the criteria for inclusion in this review. A positive association between estimated vitamin B12 intake and SES was observed in 6 studies. One study reported no association.
Conclusion Education and income are both associated with vitamin B12 intake in community-dwelling elderly. The reasons for this association could not be resolved within this review. Future studies with larger sample sizes and generalizable populations are needed.

Keywords Vitamin B12 · socio-economic status · elderly · systematic review · community-dwelling

Introduction

Socio-economic status (SES), often indicated by education- and income levels, has been found to be associated with diet quality in the general population (1). Several studies have shown that people with higher levels of education and higher income have healthier diets, with a higher intake of fiber and vitamin D, and a lower intake of saturated fats and added sugars (1-4).

It is well-known that malnutrition in the elderly can be an underlying cause of many diseases and poor health outcomes (5). In particular, malnutrition among older adults dependent on assisted living has been well-studied; however, there is a lack of knowledge on the nutritional status of community-dwelling older adults, who are healthy enough to live independently in their own homes (6).

In addition to an increase in life expectancy, older adults seem to have become healthier over time. For example, recent born generations of 80-year-olds, have similar mean grip strength as 75-year-olds born one generation earlier (7). However, frailty and physical limitations, along with concomitant diseases, often increase as people age (8). These circumstances can negatively influence the nutritional status, which can lead to insufficient food intake and possibly to malnutrition (6).

Although the energy requirement often decreases with age due to reduced muscle mass and lower physical activity, the need for some vitamins and minerals e.g., vitamin B12 remains unchanged (9). It can even increase due to reduced absorption capabilities, for example, through the intake of medication (10).

Vitamin B12 is a micronutrient that is essential to form red blood cells, DNA and function of the central nervous system. It is synthesized exclusively by microorganisms in the gut of animals (11-13), and the only sources of vitamin B12 for humans are animal-based products such as meat, fish, and milk products or dietary supplements and prescription medications (14).

Poor general health, low appetite, but also low educational- and income-level have been found to be associated with malnutrition and low-quality diet in older adults (15-18). In particular, older adults with low SES may have a lower intake of micronutrients compared with older adults with higher SES (17).

In the current systematic review, we would like to summarize the association between socio-economic factors (education level, income, and social class) and dietary intake (including supplements) of vitamin B12 in community-dwelling older adults.

Methods

Literature search and study selection

A systematic literature search was undertaken according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline to identify eligible studies related to vitamin B12 intake of the elderly and SES. Four databases: MEDLINE, Embase, CINAHL and Scopus, were searched for articles published from 1st of January 1946 to 11th December 2020 by a certified librarian and adviser at the library of medicine and science of the University of Oslo (UiO), using database-specific keywords for the three determining variables of the search: (1) Socio-economic indicators, (2) Older community-dwelling adults (≥60 years), (3) Vitamin B12 intake via diet. The specific search terms used for each database can be found in Appendix 1.

Inclusion and exclusion criteria

Studies were included if they assessed the vitamin B12 intake in community-dwelling participants aged 60 years or older through their diet (including supplements), in relation to their SES. Studies measuring vitamin B12 in serum rather than through dietary intake, studies conducted in nursing home residents, focusing on adults younger than 60 years only, or non-English language abstracts only were excluded.

Studies identified through database search were initially screened using the Rayyan web tool. Rayyan enables a speedier title and abstract screening by highlighting user-defined keywords (19). Articles were then classified as either initially "included", "excluded", or "maybe" in cases when the abstract did not provide enough information on the variables of the search. Full texts of articles, classified into groups initially included and maybe, were assessed against the review criteria and either included or excluded. Any disagreements were discussed with the second reviewer (KG).

Data extraction and quality assessment

Characteristics of the included studies [author, year, article title, country, population (age, special characteristics, and the number of subjects), study design, exclusion criteria, main findings and findings according to SES] were extracted into an excel spreadsheet.

For quality assessment of the included studies, the Newcastle-Ottowa Scale (NOS) was used.

NOS is recommended by the Cochrane Collaboration to assess the quality of nonrandomized studies (20). The scale awards a maximum of nine stars to cohort studies to identify high-quality studies according to three perspectives: selection of the study groups, comparability, and ascertainment of the outcome (21). An adapted version for cross-sectional studies by PA Modesti et al. was used, which awards up to ten stars (22). Two independent authors (DB and KG) assessed the study quality, and uncertainties were resolved through discussion. On this scale, a score of <4, 4-6, 7-10, were defined as poor, moderate, and good quality, respectively.

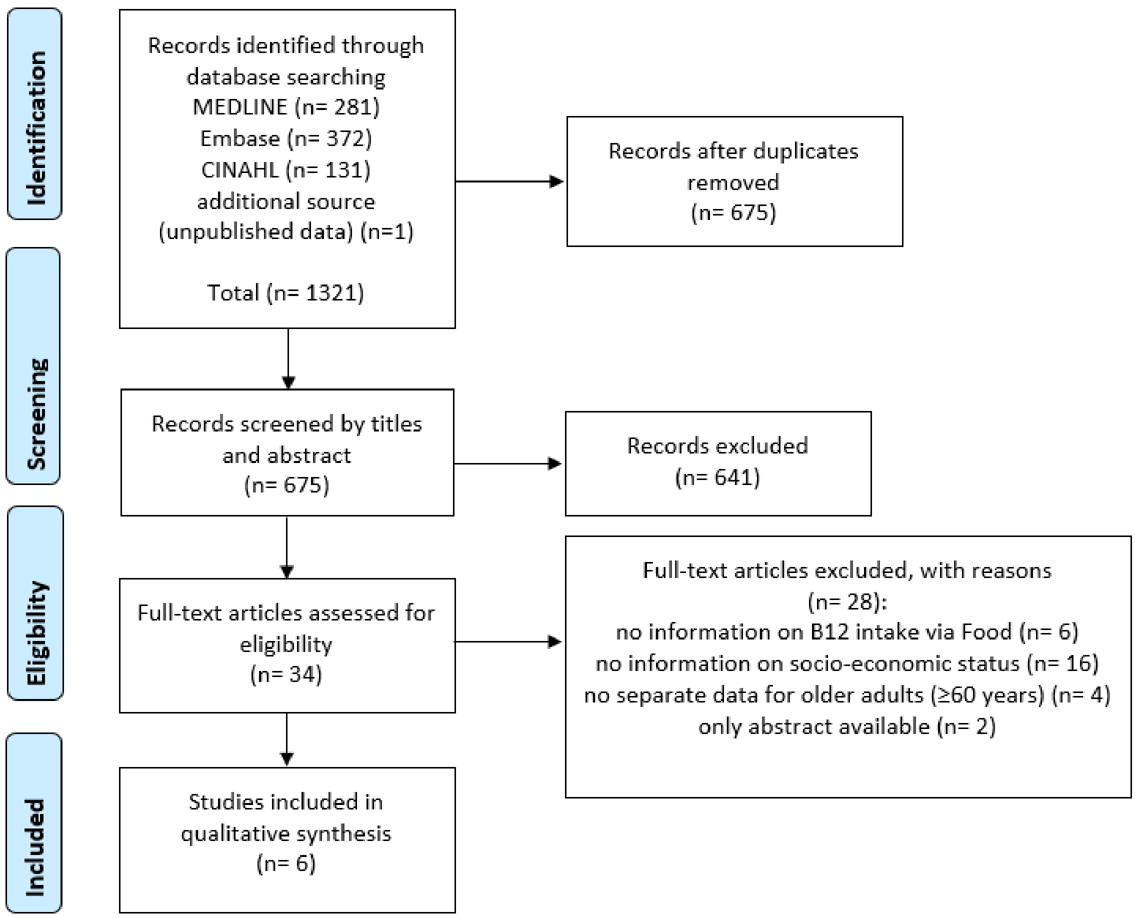

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart of the literature search process

Additional data

We were also able to obtain unpublished data from a recent study conducted in senior centers in Oslo (Norway) with 101 community-dwelling elderly (26 men and 68 women) ≥65 years with a mean age of 76 years to supplement this systematic review. The study was conducted between November 2019 and January 2020 in selected senior centers in different districts of Oslo. These senior centers are a low threshold open social offer for elderly people living in their own homes. Participation was voluntary, and participants were offered help in completing the questionnaires. Data on dietary intake were collected using a Food Frequency Questionnaire (FFQ), a certified dietary assessment tool that has been used in many previous dietary studies in Norway (e. g. the Tromsø study) (23). Education level was self-reported and categorized into high (>12 years) versus low (≤12 years).

Results

Study selection

A total of 1321 studies were retrieved from the literature search including the unpublished study, of which 646 duplicates were removed. Of the remaining 675 studies, 641 were excluded according to the inclusion and exclusion criteria based on the information provided in the title and the abstract. Major reasons for exclusion were the other ages of the populations and that vitamin B12 status was only assessed in blood samples, not from dietary intake. A total of 34 studies were full text assessed, and 28 were excluded. This was mainly because they did not have any separate information on vitamin B12 intake in older adults (≥60 years).

Study characteristics and quality assessment

Characteristics of the studies included in the present systematic review as well as their quality NOS scores are presented in Table 1.

Of the total seven studies included in the qualitative review, five were of cross-sectional design (24-28), and two were cohort studies (29, 30). Three were judged to be of high quality (28-30) and four studies of sufficient quality (24-27).

The total number of participants in the different studies ranged from 101 to 7,030 participants, with 10,251 participants in total. The age of the study participants in one study was 85 years and older. The other studies focused on 60 and 70 years old and above.

Except for one study (30), which included only women, all focused on both genders. Studies were performed in Norway, the USA, Italy, Brazil and three studies in the UK (25, 27-32).

Two studies in the UK have been performed by C. J. Bates as lead author and are both based on the data retrieved by the 1994–5 British National Diet and Nutrition Survey (NDNS) (26, 27).

Table 1 Characteristics of studies included in the systematic review

Author, Year	Article title	Country	Population	Exclusion criteria	Study design	Main findings	Results according to SES	Quality NOS
Unpublished (24)	Study of nutritional intake in community dwelling older adults in Oslo	Norway	n: 101 age: ≥60 years	Individuals who were not able or willing to complete the questionnaires even with assistance.	cross-sectional	The mean vitamin B12 intake of the participants was above the recommended daily intake by the Nordic Council of Ministers (2.0 µg/day), also when excluding B12 supplements. The mean intake decreased with increasing age. Education level has no significant association with the intake of vitamin B12 in older adults.	Education (years) Without supplements ≤13: 6.4 µg/day >13: 6.3 µg/day With supplements ≤13: 6.7 µg/day >13: 6.8 µg/day	7
Mendonca et al., 2016 (29)	Micronutrient intake and food sources in the very old: analysis of the Newcastle 85+ Study	UK	n: 793 age: ≥85 years	No information available	cohort	Higher vitamin B12 intake in people of better social class and with more years of education (peak at 10-11 y), drops slightly at 12 and more years. 10% below Lower Reference Nutrient Intake (LRNI)1.0 µg/day	Education (years) ≤9: 2.8 µg/day 10-11: 3.1 µg/day ≥12: 3.0 µg/day Social Class Class 1: 3.0 µg/day Class 2: 2.8 µg/day Class 3: 2.8 µg/day	9
Venturini et al., 2015 (25)	Consumption of nutrients among the elderly living in Porto Alegre in the State of Rio Grande do Sul, Brazil: a population-based study	Brazil	n: 427 age: ≥60 years 54.9% underweight	Individuals whose information was incorrect and/or incomplete	cross-sectional	Higher education was associated with higher intake of vitamin B12; A family income of 2-5 times the minimum wage showed the greatest consumption of vitamin B12. At incomes of > 5 times the minimum wage the intake was as low as at levels up to an income of 2 times the minimum wage. The vitamin B12 intake was highest at the age 60-69 and became lower at 70-79 with lowest intakes at ≥80.	Education (years) <8: 4.1 µg/day ≥8: 6.1 µg/day (p-value difference=0,027) <2 times minimum wage: 4.7µg/day 2-5 times mimimum wage: 6.2 µg/day >5 times minimum wage: 4.9 µg/day (p-value difference=0.53)	7
Agnew-Blais et al., 2014 (30)	Folate, Vitamin B-6, and Vitamin B12 Intake and Mild Cognitive Impairment and Probable Dementia in the Women's Health Initiative Memory Study	USA	n: 7,030 Age: 65-79 years Postmenopausal women	MCI/probable dementia Subjects with missing information on several confounders, including education,	cohort	Only 2.5% (n: 174) fell below the Recommended Daily Allowance (RDA) (2.4 µg/day) for vitamin B12 intake. Subjects who fell below the RDA were significantly less likely to take supplements, more likely to be nonwhite, have a lower level of education and income.	%<2.4 µg/day by education: 0-8 years/some high school: 56.3% High school/some college: 21.3 % College grad/postgrad: 22.4 % %<2.4 µg/day by income <19,999: 35.1% 20,000-34,999: 33.9%	8

Table 1 Characteristics of studies included in the systematic review

Author, Year	Article title	Country	Population	Exclusion criteria	Study design	Main findings	Results according to SES	Quality NOS
				were excluded from analyses			35,000-49,999: 17.2% 50,000-74,999: 10.9% ≥75,000: 2.9% %≥2.4 µg/day by education 0-8 years/some high school: 42.0% High school/some college: 27,6% College grad/postgrad: 30,4% %≥2.4 µg/day by income <19,999: 24.7% 20,000-34,999: 34,4% 35,000-49,999: 20.0% 50,000-74,999: 13.4% ≥75,000: 7.6% p-value of difference (education)<0.001 p-value of difference (income)<0.01	
Bates et al., 2003 (27)	Relationship between methylmalonic acid, homocysteine, vitamin B12 intake and status and socio-economic indices, in a subset of participants in the British National Diet and Nutrition Survey (NDNS) of people aged ≥65 years	UK	n: 313 (subgroup) age: ≥ 65 years Analysis performed on a subset of unused plasma samples from the NDNS	No information available	cross-sectional	No significant association between socio-demographic indicators such as poverty, social class and low level of education and low vitamin B12 intake. Vitamin B12 status may depend on longterm variations in vitamin B12 intake due to low correlation between serum vitamin B12 and vitamin B12 intake.	Vitamin B12 intake was lower, in those who had not obtained an education up to at least the equivalent of Certificate of Secondary Education (CSE) Significant association between Methylmalonic acid (MMA) as a specific marker of functional vitamin B12 status and education (p value of difference=0.0005) p-value of difference (education)=0.3 p-value of difference (income)=0.8	7

Table 1 Characteristics of studies included in the systematic review

Author, Year	Article title	Country	Population	Exclusion criteria	Study design	Main findings	Results according to SES	Quality NOS
Bates et al. 1999 (26)	Micronutrients: highlights and research challenges from the 1994–5 National Diet and Nutrition Survey (NDNS) of people aged 65 years and over	UK	n:284 (subgroup) age: 65– 95 years	No information available	cross-sectional	Below Reference Nutrient Intake (RNI): 3% (1.5 µg) n:1310 Socio-economic factors were not associated with variations in serum vitamin B12.	Group 1 Family income <£6000 per annum, receiving state benefit, living in the north of England or in Scotland 3.7 µg/day Group 2 Family income >£6000 per annum, not receiving state benefit and living in the remainder of mainland Britain p-value of difference= 0.003 4.7 µg/day	5
Bianchetti et al., 1990 (28)	Nutritional intake, socio-economic conditions, and health status in a large elderly population	Italy	n: 1,303 age: 70-75 years	Hospitalization during the period of inquiry	cross-sectional	About a third of the subjects had an inadequate intake of vitamin B12 (RDA 3.0 µg/day). Inadequate dietary intake correlated more strongly with socio-economic conditions than with physical health status. A higher percentage of low-income individuals had inadequate intakes than those with low levels of education.	Percentage of individuals with intake below 3.0 µg/day: Low income (below 4800$ per year) (m): 35.5 % p -value of difference from those with high income: < .05 (f) 37.5 % p -value of difference from those with high income < .01 High income (m): 25.8 % (f): 25.9 % Low educational level (less than 3 years) (m) 32.8 % (f) 33.7 % High educational level (m) 26.9 % (f) 30.4 %	8

Results of Individual Studies

Of the seven studies included, one study included participants with different educational background as SES indicator only (24). Four studies included participants with different educational backgrounds and income levels (25, 27, 28, 30), one study focused on participants with different educational background and social class (29). The last of the seven studies combined the SES indicators income, receiving state benefit and the place of residence (26).

Seven to nine years or less of formal education was defined as low education in three studies (25, 29, 30). Another study defined low education by school attendance of three years or below (28). Whereas the study conducted in Oslo defined low education by school attendance up to 13 years (24). Low income was defined as an individual income below 500,000 lire per month (about 4800$ per year) (28), below 19,000$ per year (30) or less than double the minimum wage (25). Receipt of state benefit was used as marker of low income by Bates in both studies (26, 27). A family income below £6000 per year was used as a second factor of low income by Bates et al. (1999).

The recent cross-sectional study from Oslo (Norway) showed that vitamin B12 intake without supplements was not significantly different in the high-education group than in the low-education group (low education: 6.4 µg/day versus high education: 6.3 µg/day), when age and sex were adjusted for, (β without supplements= 0.005; 95% CI: -1.17, 1.18). The average vitamin B12 intake with supplements included was not significantly between the educational groups (low education: 6.72 µg/day versus high education: 6.77 µg/day), (β with supplements= 0.21; 95% CI: -0.93, 1.33). The quality of this study according to NOS was downgraded due to the low number of participants (n:101) and the high cut off level for a low educational level (0-13 years).

When stratifying on gender, the proportion of participants in the low education group in the study by Bianchetti et al. (1990) showing a vitamin B12 intake below 3 µg/day was 32.8% for men and 33.7% for women. In contrast, only 26.9% of men and 30.4% of women in the higher education group fell below a daily intake of 3 µg. The percentage of participants in the low-income group found a vitamin B12 intake below 3 µg/day is 35.5% for men and 37.5% for women. In contrast, only 25.8% of men and 25.9% of women in the higher income group had a daily intake below 3 µg. Consequently, the study found that income had a stronger association with vitamin B12 intake than education (28).

Bates et al. (1999) showed that group 1 of the participants with the SES indicators: family income of <£6000 per year, receiving state benefit and living in north of England or in Scotland had a mean intake of vitamin B12 of 3.7 µg /day. Group 2 of the participants with the SES indicators: family income of >£6000 per year, not receiving state benefit and living in the remaining mainland of Britain at the other hand had a mean intake of 4.7 µg /day. However, there is no data on the influence of income considered by itself on vitamin B12 intake. Participants with SES indicators, which did not fit in either group 1 or 2 (e.g., receiving state benefit and living in the south of England) were not considered for this analysis.

The other study performed by Bates as lead author (2003) could not find an association between income and vitamin B12 intake. Both studies (1999 & 2003) were based on the 1994–5 British National Diet and Nutrition Survey (NDNS) with 1,310 participants but used data from a subset of participants (284 and 313 participants, respectively). Bates et al. (2003) did only include participants for whom the Methylmalonic acid (MMA) concentrations were measured in plasma samples. Bates et al. (1999) did not describe the selection process in detail. Therefore, and for grouping of SES indicators, the results should be evaluated with caution.

In the study performed in the USA by Agnew-Blais et al. (2014) 56.3 % of the women in the low education group had a vitamin B12 intake below 2.4 µg/day and 42% of women had a vitamin B12 intake of ≥2.4 µg /day, respectively. Whereas 22.4 % of the women in the high education group had an intake below 2.4 µg/day and 30.4 % a vitamin B12 intake of ≥2.4 µg /day (30). In the lowest income group 35.1 % of the individuals had a vitamin B12 intake below 2.4 µg/day and 24.7% of women had a vitamin B12 intake of ≥2.4 µg/day, respectively. Whereas 2.9 % of all women, belonging to the highest income group had an intake below 2.4 µg/day and 7.6 % a vitamin B12 intake of ≥2.4 µg /day (30).

Venturini et al. (2015) showed that the vitamin B12 intake in Brazilian elderly was significantly different in the high-education group than in the low-education group (low education: 4.1 µg/day versus high education 6.1 µg/day). The authors also noted a considerable drop in the intake from 6.2 µg /day of vitamin B12 at the middle income group to 4.9 µg /day at the highest income group, a level almost as low as in the lowest income group (4.7 µg/day) amongst Brazilian elderly (25).

In contrast to the study performed by Bianchetti et al. (1999) in Italy, the studies in the USA and Brazil found that education had a stronger association with vitamin B12 intake than income (25, 30).

The study by Mendonca et al. (2016), performed in the UK, also found that the vitamin B12 intake was slightly lower (3.0 µg /day) at the highest level of education (≥12 years), compared to participants with a medium level of education (3.1 µg /day), but still being higher than for participants with a low educational level (2.8 µg /day) (29). Rather than assessing the differences in income, the study by Mendonca et al. (2016) assessed the micro-nutrient intake (including B12) according to different social classes. Social class was determined based on the occupation the participants reported to have had before retirement (29). The highest social class (1 out of 3) had the highest vitamin B12 intake (3.0 µg /day), the other two classes showed no difference in intake (both 2.8 µg /day).

Synthesis of results

The mean intake of vitamin B12 by educational status was between 3.1 – 6.8 µg/day in the high-education group and 2.8 – 6.7 µg/day in the low education group in the three studies that reported mean intake values (24, 25, 29).

Only one study reported mean values for vitamin B12 intake according to income classes, those were 4.7 µg/day in the low-income group and 4.9 µg/day in the highest income group. The highest intake was noted for the middle-income group (6.2 µg/day) (25). Another study, which included income in addition to the place of residence and receipt of social benefits as SES indicator observed intake values of 4.7 µg/day in the low SES and 4.9 µg/day in the high SES group (26).

The study assessing the vitamin B12 intake according to social classes in addition to the education observed that the highest social class (1 out of 3) had the highest vitamin B12 intake (3.0 µg /day) compared to classes 2 and 3 (both 2.8 µg /day) (29).

In conclusion, six out of seven studies found a positive association, whereas one study could not find any association between SES and vitamin B12 intake. Five out of seven studies assessed B12 intake levels according to income. Four studies concluded that low income was associated with a low vitamin B12 intake (25, 26, 28, 30).

Six out of seven studies assessed B12 intake levels according to education. Of those, five studies found an association between high and middle income and a high vitamin B12 intake (25, 27-30). Two studies found that education had a higher influence compared to the income. Another study came to the opposite conclusion (28). Furthermore, there were differences in one study to what extent the income had an influence on the intake of vitamin B12.

Secondary findings

Inadequate intake The proportion of older adults showing an inadequate intake of vitamin B12 ranged from 2.5% to 33% in the different studies. In four studies the proportion of participants with an intake of vitamin B12 below the recommended amount was less than or equal to 10%. One study did not give an exact proportion of individuals who fell below the recommended amount (25).

Relation between Vitamin B12 intake and serum Vitamin B12 A survey performed by Bates et al. (1999 & 2003) assessed the relation between vitamin B12 intake and vitamin B12 serum status, and socio-economic key indicators in people aged ≥65. One finding of this survey was that serum vitamin B12 concentrations did not significantly correlate with the vitamin B12 intake of the participants. Furthermore, there was no evidence for any socio-economic influences on serum vitamin B12 status.

Certainty of the overall evidence and Reporting Biases

Certainty of evidence was rated according to the GRADE (Grading of Recommendation, Assessment, Development and Evaluation) approach applied for a narrative summary of the effect (33).

The total overall quality of evidence for all included studies was low. The level of evidence was downgraded due to a high risk of bias, indirectness and imprecision and heterogeneity between populations as some minor differences were observed for European and South American population.

Most of the studies did not indicate the selection process, and thus possibly introducing selection bias. The study with the highest number of participants consisted of women only, reducing the generalizability to male populations. Another study did include 101 participants only. Hence, both contributed to rating imprecision as borderline. Most of the studies did not include exclusion criteria regarding existing diseases of the participants. There were also concerns about the different classification of low and high education (e.g., according to years of attendance or school-leaving qualification) and different cut-off levels for low income in the individual studies, and different types of FFQs with different calculation methods being used. The indirectness was therefore classified as borderline.

Overall, the outcome of the eligible studies was consistent and showed a positive association between SES and vitamin B12 intake. However, there were no published studies of no association, which could indicate a possible publication bias excluding negative findings. Also, only a few countries had studies that were eligible for this review, which means that findings may not be generalizable to the world-population.

Discussion

The present systematic review supports the hypothesis that higher SES is associated with higher intake of vitamin B12 in people aged ≥60 years

Studies conducted in younger people have found a associations between low SES and a lower intake of several micronutrients (1, 34, 35). The US National Health and Nutrition Examination Survey (NHANES) from 2003 to 2016, which included participants 19-46 years found that the population with low SES was at higher risk for not meeting the dietary reference intakes (DRIs) for several nutrients, including vitamin B12 (36). A cross-sectional analysis in France with more than 90,000 participants showed that particularly education is positively associated with high intakes of nutrients, but this study did not include B12 intake (37).

Another dietary survey among 1,787 adults between 18 and 70 years old conducted in Norway demonstrated that people with higher education consumed a healthier diet compared to people with lower education. However, no significant difference in vitamin B12 intake could be established between the different levels of education (38).

One possible explanation for the association between SES and B12 intake is that people with a higher level of education may have more knowledge about nutrition and health ("health literacy"), leading to a healthier nutritional pattern than among people with a low level of education (39, 40).

Another factor is that the low-quality foods high in sugar and fat, but low in micronutrients, are mostly cheap, easily available, and more often consumed by those with low income. Moreover, low-quality food is usually easier to store and quicker to prepare than fresh meat and vegetables.

The importance of such factors is likely to vary between low-, middle- and high-income countries.

The higher intake of micronutrients is usually explained by a higher consumption of vegetables, fruits, and fish in people with higher SES. Vitamin B12 is, however, only found in animal products, which means that there must be a different underlying explanation. One possible explanation is that low-income groups in particular cover their calorie needs with inexpensive foods that are rich in sugars and vegetable fats (41). Higher income groups, on the other hand, to a larger degree follow a diet rich in seafood, lean meat, and vegetables (42). Moreover, supplement use is more prevalent among people with higher SES (43).

A study performed in Puerto Rico concluded that education had a greater influence on vitamin B12 intake than income, with higher intakes of B12 with high education, but not so with income. The authors highlighted that a higher intake of fast food and fried foods, known to be nutrient-poor and with high calorie density, is more often consumed by people with higher income (32).

A similar association could be the reason for the decrease of vitamin B12 intake in the highest income group in the survey performed in Brazil. An article published in the New York Times describes a trend towards highly processed food that is emerging in Brazil, also due to rising incomes and a demand for convenience (44) . On the contrary, the trend in European countries turns towards a healthier diet (45). In a survey on behalf of the German Bundesministerium für Gesundheit und Ernährung from 2021, 91% of the participants indicated that healthy food is important to them. This is also reflected by the increased consumption of vegetables and fruit in 2021 compared to 2020 (46). The phenomenon whereby a population moves from plant-based diets rich in fiber and micronutrients to highly processed food and in the later so called "behavioral pattern" to more healthy food is referred to as "nutrition transition" (47). Nutrition transition was found to initially affect the population with higher SES (48). This could be the reason for the different outcomes according to SES groups and countries observed in the current review.

Discussion of secondary finding: Inadequate intake

Different studies used different cut-off values for adequate intake applied by the authors, which made it difficult to compare the proportion of study participants with poor vitamin B12 intake. Adequate intake reference values for vitamin B12 in the present systematic review ranged from 1.0 to 3.0 µg/day as the studies either referred to the (lower) reference nutrient intake [(l)RNI], the recommended daily allowance (RDA) or other local recommendations. The study with the highest reference value of 3 µg/day, performed by Bianchetti et al. also presented the largest portion of subjects with inadequate vitamin B12 intake (approximately one third) (28). 1 out of the 4 studies that presented a mean intake value of vitamin B12 found a mean intake below the highest reference value.

Discussion of secondary finding: Relationship between Vitamin B12 intake and serum Vitamin B12

The National Institutes of Health (NIH) of the US Department of Health and Human Services (2021) lists atrophic gastritis as one of the most common reasons for vitamin B12 deficiency in older adults (49). The differences in the absorption of vitamin B12 may be a reason for the non-significant correlation between vitamin B12 serum concentration and oral intake in the study performed by Bates et al. (27).

Limitations and Recommendations

To the best of our knowledge, this is the first systematic review to look at the association between SES and the intake of vitamin B12 in older community-dwelling adults. The strengths of this study include the use of a robust and comprehensive search in several databases performed by an expert librarian, a thorough screening strategy using applicable software, and a methodical procedure and reporting according to the PRISMA guidelines. We also included unpublished data from a recent Norwegian study of community-dwelling adults.

However, this review also presents possible limitations.

First, this review included only studies with an abstract in English language. Five of the seven included studies were conducted in Europe. The inclusion of studies published in any other language than English could have identified different associations between SES and vitamin B12 intake in low- and high-income countries.

Second, the exclusive search for publications in English language could have also introduced language bias as negative results or non-significant results are more likely to be published in local language. The non-publication of negative results in journals with high impact could have also led to publication bias. The literature search could have included grey literature such as research reports and academic papers to reduce publication bias. The current review did not include any eligible published studies of no association, which could be indicative for a publication bias.

Third, included studies had various dietary assessment methods, different classifications of income and education, and heterogeneous calculation methods, which could lead to an inaccurate overall result, and it also made it impossible to perform a meta-analysis. However, the finding of a positive association between SES and B12 intake despite these different assessment methods makes our finding more robust.

For future studies, a larger population, and the use of uniform and validated dietary assessment methods are recommended. The inclusion of a greater number of countries could also help to understand the relation between the nutrition transition taking place across the world, SES, and vitamin B12 intake.

Conclusion

Findings from this review suggest that SES is, overall, positively associated with dietary vitamin B12 intake in community-dwelling older adults. Which of the two indices of SES, education or income, has a greater influence on vitamin B12 intake in older people may depend on the cultural background and stage of nutrition transition of the respective country.

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Appendix II: Food Frequency Questionnaire

Prøv så godt du kan å gi et "gjennomsnitt" av dine spisevaner.
Ha det siste året i tankene når du fyller ut.

1. Hvor mye brød pleier du å spise?

Legg sammen det du bruker til alle måltider i løpet av en dag.
(1/2 rundstykke = 1 skive, 1 baguett = 4 skiver, 1 ciabatta = 2 skiver)

	Aldri/ sjelden	Antall skiver pr. dag ½	1	2	3	4	5	6	7	8	9	10	11	12+
Fint brød (loff, baguetter, fine rundstykker, ciabatta)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mellomgrovt brød (helkornbrød, kneipp, grove rundstykker)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Grovt brød (mer enn 50 % sammalt, mørkt rugbrød)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fint knekkebrød (kavring)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Grovt knekkebrød (grov skonrok)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Sum skiver pr. dag = ______

Antall skiver pr. uke: __________ x 7 = ______.   Tallet brukes i spørsmålene 2 og 4.
(sum skriver pr. dag)

2. Hva pleier du å smøre på brødet?

Legg sammen det du bruker på skivene i løpet av en uke.
(1/2 rundstykke = 1 skive, 1 baguett = 4 skiver, 1 ciabatta = 2 skiver, 1 knekkebrød = 1 skive)

	Aldri/ sjelden	Antall skiver pr. uke 1-5	6-14	15-21	22-28	29-35	36-42	43-49	50-56	57+
Smør (meierismør)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bremykt	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Brelett	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Myk margarin (Soft Flora, Soft Ekstra)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Soft Oliven	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Vita	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Soft Light, Vita Lett	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Melange	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Annen margarin	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Olivenolje, annen olje på brød	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Majones, remulade på brød	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. Hvis du bruker smør/margarin på brødet, hvor mye bruker du?

	Antall skiver ½	1	2	3	4	5 eller flere
En porsjonspakke smør/margarin på 12 g rekker til antall skiver:	☐	☐	☐	☐	☐	☐

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4. Hvilke typer pålegg spiser du?

	Aldri/ sjelden	Til antall skiver pr. uke 1	2-3	4-5	6-7	8-12	13-18	19-24	25-30	31+
Brunost/prim	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lett/mager brunost/prim	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hvitost (eks. Norvegia, Gulost)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lett/mager hvitost	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dessertost (eks. Brie, Gräddost, blåmuggoster)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Smøreost (eks. kremost, Philadelfia)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lett/mager smøreost	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Leverpostei	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mager leverpostei	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Servelat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kokt skinke, lettservelat, kalkunpålegg	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Salami, fårepølse, spekepølse	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kaviar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Svolværpostei, Lofotpostei	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Makrell i tomat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Røkt, gravet laks/ørret	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sardiner, sursild, ansjos	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tunfisk	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Reker, krabbe	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Egg (kokt, stekt, eggerøre)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Syltetøy, marmelade	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lett syltetøy, frysetøy	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Peanøttsmør	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sjokolade-, nøttepålegg	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Annet søtt pålegg (eks. honning, Sunda, sirup)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cottage cheese	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Majonessalat (eks. italiensk salat)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Majonessalat lett (eks. lett italiensk salat)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Frukt som pålegg (eks. banan, eple)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Grønnsaker som pålegg (eks. agurk, tomat)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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Prøv så godt du kan å gi et "gjennomsnitt" av dine spisevaner.
Ha det siste året i tankene når du fyller ut.

5. Frokostgryn
Svar enten per måned eller per uke.

	Aldri/ sjelden	Gang pr. måned			eller Gang pr. uke						Mengde pr. gang			
		1	2	3	1	2-3	4-5	6-7	8+		1	1½	2	3+
Havregrøt										(dl)				
Havregryn, 4-korn										(dl)				
Mysli, søtet (eks. Solfrokost)										(dl)				
Mysli, usøtet (eks. Go'Dag)										(dl)				
Cornflakes										(dl)				
Honnikorn/Frosties/Chocofrokost										(dl)				
All Bran, Weetabix, Havrefras o.l.										(dl)				
Puffet ris, havrenøtter										(dl)				

	Aldri/ sjelden	Gang pr. måned			eller Gang pr. uke						Mengde pr. gang			
		1	2	3	1	2-3	4-5	6-7	8+		1	1½	2	3+
Syltetøy til frokostgryn, grøt										(ss)				
Sukker til frokostgryn, grøt										(ts)				

6. Melk (Husk også å ta med melk du bruker på frokostgryn, grøt og dessert)
(1 glass = 2 dl)

	Aldri/ sjelden	Antall glass pr. dag							
		½	1	2	3	4	5	6	7+
Helmelk, kefir, kultur									
Lettmelk									
Ekstra lettmelk									
Skummet melk, skummet kultur									
Biola/Cultura naturell									
Biola/Cultura med bær/frukt									
Sjokolademelk, jordbærmelk									
Drikkeyoghurt									

7. Yoghurt (Husk å ta med yoghurt du bruker til frokostgryn)
Svar enten per måned eller per uke.

	Aldri/ sjelden	Gang pr. måned			eller Gang pr. uke					Beger pr. gang			
		1	2	3	1	2-3	4-5	6-7	8+	½	1	2	3+
Yoghurt naturell (125 g)													
Yoghurt med frukt (125 g)													
Go'morgen yoghurt m/mysli													
Lettyoghurt med frukt (125 g)													
Lettyoghurt m/mysli													

8. Kalde drikker

Svar enten per uke eller per dag, <1 betyr sjeldnere enn 1 gang. Merk at porsjonsenhetene er forskjellige, 1/5 liter tilsvarer ett glass (2 dl), mens 1/3 liter tilsvarer 0,33 liter glassflaske/boks.

	Aldri/ sjelden	Gang pr. uke <1	1-2	3-4	5-6	eller Gang pr. dag 1	2	3	4+	Mengde pr. gang				
Vann (springvann)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(glass)	1 ☐	2 ☐	3 ☐	4+ ☐
Flaskevann med/uten kullsyre (eks. Farris, Imsdal)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1+ ☐
Appelsinjuice	☐	☐	☐	☐	☐	☐	☐	☐	☐	(glass)	1 ☐	2 ☐	3 ☐	4+ ☐
Eplejuice, annen juice	☐	☐	☐	☐	☐	☐	☐	☐	☐	(glass)	1 ☐	2 ☐	3 ☐	4+ ☐
Eplenektar, annen nektar	☐	☐	☐	☐	☐	☐	☐	☐	☐	(glass)	1 ☐	2 ☐	3 ☐	4+ ☐
Saft med sukker	☐	☐	☐	☐	☐	☐	☐	☐	☐	(glass)	1 ☐	2 ☐	3 ☐	4+ ☐
Saft, kunstig søtet	☐	☐	☐	☐	☐	☐	☐	☐	☐	(glass)	1 ☐	2 ☐	3 ☐	4+ ☐
Brus med sukker	☐	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1+ ☐
Brus, kunstig søtet	☐	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1+ ☐
Iste med sukker	☐	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1+ ☐
Iste, kunstig søtet	☐	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1+ ☐
Alkoholfritt øl (eks. Vørterøl, Munkholm)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1+ ☐

9. Alkoholholdige drikker

Svar enten pr. måned eller pr. uke. Merk at porsjonsenhetene er forskjellige, 1/5 liter tilsvarer ett glass (2 dl), mens 1/3 liter tilsvarer 0,33 liter glassflaske/boks.

	Aldri/ sjelden	Gang pr. måned 1	2	3	eller Gang pr. uke 1	2-3	4-5	6-7	Mengde pr. gang						
Øl, sterk øl, pils	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/3 ☐	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Lettøl	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/3 ☐	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Rusbrus, Cider m/alkohol	☐	☐	☐	☐	☐	☐	☐	☐	(liter)	1/5 ☐	1/3 ☐	½ ☐	1 ☐	1½ ☐	2+ ☐
Rødvin	☐	☐	☐	☐	☐	☐	☐	☐	(vinglass)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Hvitvin	☐	☐	☐	☐	☐	☐	☐	☐	(vinglass)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Hetvin (portvin, sherry o.l.)	☐	☐	☐	☐	☐	☐	☐	☐	(1 glass = 4cl)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Brennevin, likør	☐	☐	☐	☐	☐	☐	☐	☐	(1 dram = 4cl)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Blandede drinker, cocktail	☐	☐	☐	☐	☐	☐	☐	☐	(drink)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐

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Prøv så godt du kan å gi et "gjennomsnitt" av dine spisevaner.
Ha det siste året i tankene når du fyller ut.

10. Varme drikker

Svar enten per uke eller per dag, < 1 betyr sjeldnere enn 1 gang.

	Aldri/ sjelden	Gang pr. uke				eller Gang pr. dag				Mengde pr. gang						
		<1	1-2	3-4	5-6	1	2	3	4+							
Kaffe - kokt og presskanne *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Kaffe - traktet, filter *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Kaffe - pulver (instant) *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Espresso *1 kopp = 0,3 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Caffe latte *1 kopp = 3 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Cappucino *1 kopp = 3 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	☐	☐	☐	☐	☐	☐
Kakao/varm sjokolade *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6+ ☐
Sort te (eks. Earl Grey, solbær) *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Grønn te *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Urtete (eks. nype, kamille, Rooibois) *1 kopp = 2 dl*	☐	☐	☐	☐	☐	☐	☐	☐	☐	(kopp)	1 ☐	2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐

	Bruker ikke	Antall pr. kopp				
		½	1	2	3	4+
Sukker til te (ts/sukkerbit)	☐	☐	☐	☐	☐	☐
Sukker til kaffe (ts/sukkerbit)	☐	☐	☐	☐	☐	☐
Sukketter til te (stk)	☐	☐	☐	☐	☐	☐
Sukketter til kaffe (stk)	☐	☐	☐	☐	☐	☐
Melk/fløte til te (ss)	☐	☐	☐	☐	☐	☐
Melk/fløte til kaffe (ss)	☐	☐	☐	☐	☐	☐

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11. Middagsretter

Vi spør både om middagsmåltidene og det du spiser til andre måltider. Legg til slutt sammen hvor mange retter per måned du har merket av for å se om summen virker sannsynlig.

	Aldri/ sjelden	Gang pr. måned							Mengde pr. gang					
		1	2	3	4	5-6	7-8	9+						
Kjøtt/kjøttretter														
Kjøttpølse av storfe/svin	☐	☐	☐	☐	☐	☐	☐	☐	(pølse)	½ ☐	1 ☐	1½ ☐	2 ☐	3+ ☐
Kjøttpølse av storfe/svin, lett/mager	☐	☐	☐	☐	☐	☐	☐	☐	(pølse)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Kjøttpølse av kylling/kalkun	☐	☐	☐	☐	☐	☐	☐	☐	(pølse)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Grillpølse/wienerpølse av storfe/svin	☐	☐	☐	☐	☐	☐	☐	☐	(pølse)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Grillpølse/wienerpølse av kylling/kalkun	☐	☐	☐	☐	☐	☐	☐	☐	(pølse)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Hamburger (m/brød)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Karbonade	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Kjøttkaker, medisterkaker, kjøttpudding	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Kjøttsaus, gryterett med kjøttdeig	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Taco (tacoskjell med kjøtt og salat)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Tortilla lefse (med kjøtt og salat)/ wrap	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Kebab	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	½ ☐	1 ☐	1½ ☐	2 ☐	3+ ☐
Lasagne, moussaka	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Pizza (en Grandiosa = ca 550 g)	☐	☐	☐	☐	☐	☐	☐	☐	(pizza)	1/8 ☐	1/4 ☐	½ ☐	3/4 ☐	1+ ☐
Calzone (1 stk = 250-300 g)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	½ ☐	1 ☐	1½ ☐	2 ☐	2½+ ☐
Pai/quiche	☐	☐	☐	☐	☐	☐	☐	☐	(bit)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Vårruller	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Biff (svin, okse, lam)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	½ ☐	1 ☐	1½ ☐	2 ☐	2½+ ☐
Koteletter (svin, okse, lam)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	½ ☐	1 ☐	1½ ☐	2 ☐	2½+ ☐
Stek (svin, okse, lam)	☐	☐	☐	☐	☐	☐	☐	☐	(skive)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Stek (elg, hjort, reinsdyr, rådyr)	☐	☐	☐	☐	☐	☐	☐	☐	(skive)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Gryterett med helt kjøtt, frikassé, fårikål	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Lapskaus, suppelapskaus, betasuppe	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐

Middagsretter fortsetter neste side.....

Prøv så godt du kan å gi et "gjennomsnitt" av dine spisevaner.
Ha det siste året i tankene når du fyller ut.

Middagsretter forts...

	Aldri/ sjelden	Gang pr. måned 1	2	3	4	5-6	7-8	9+	Mengde pr. gang	
Kjøtt/kjøttretter forts...										
Bacon, stekt flesk	☐	☐	☐	☐	☐	☐	☐	☐	(skive)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Grillet kylling	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/4 ☐ 1/3 ☐ 1/2 ☐ 3/4 ☐ 1+ ☐
Kyllingfilet	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	½ ☐ 1 ☐ 1½ ☐ 2 ☐ 3+ ☐
Wok med kjøtt/kylling og grønnsaker	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Kyllinggryte	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Fisk/fiskeretter										
Fiskekaker, fiskepudding	☐	☐	☐	☐	☐	☐	☐	☐	(kake)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Fiskeboller	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-9 ☐ 10+ ☐
Torsk, sei, hyse, steinbit, uer (kokt)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Torsk, sei, hyse, steinbit, uer (stekt, panert)	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Fiskepinner	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-9 ☐ 10+ ☐
Sild (fersk, speket, røkt)	☐	☐	☐	☐	☐	☐	☐	☐	(filet)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Makrell (fersk, røkt)	☐	☐	☐	☐	☐	☐	☐	☐	(filet)	½ ☐ 1 ☐ 1½ ☐ 2 ☐ 3+ ☐
Laks, ørret (kokt, stekt)	☐	☐	☐	☐	☐	☐	☐	☐	(skive)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Fiskegryte, fiskesuppe	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Fiskegrateng	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Reker, krabbe	☐	☐	☐	☐	☐	☐	☐	☐	(dl, renset)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐
Wok med sjømat og grønnsaker	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Annet										
Rømmegrøt	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Risengrynsgrøt, annen melkegrøt	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Pannekaker	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Suppe (tomat, blomkål, ertesuppe)	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Vegetarrett, vegetarpizza, grønnsaksgrateng	☐	☐	☐	☐	☐	☐	☐	☐	(bit/dl)	1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ 9+ ☐
Hurtignudler (eks. Mr Lee)	☐	☐	☐	☐	☐	☐	☐	☐	(pakke)	½ ☐ 1 ☐ 1½ ☐ 2 ☐ 3+ ☐
Omelett	☐	☐	☐	☐	☐	☐	☐	☐	(av antall egg)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+ ☐

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12. Poteter, ris, spagetti, grønnsaker

Svar enten per måned eller per uke.
Disse spørsmålene dreier seg først og fremst om tilbehør til middagsretter, men spiser du for eksempel en rå gulrot eller salat til lunsj, skal det tas med her.

	Aldri/ sjelden	Gang pr. måned 1	2	3	eller Gang pr. uke 1	2-3	4-5	6-7	8+		Mengde pr. gang				
Poteter, kokte og bakte	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Potetmos	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Potetsalat m/majones	☐	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	1 ☐	2-3 ☐	4-5 ☐	6-7 ☐	8+ ☐
Fløtegratinerte poteter	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Stekte poteter	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Pommes frites (gatekjøkken, frityrstekt)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Pommes frites, varmet i ovn	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Bønner/linser	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Ris	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Spagetti, makaroni, pasta	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Pølsebrød, lomper	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Gulrot	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Hodekål	☐	☐	☐	☐	☐	☐	☐	☐	☐	(skalk)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Kålrot	☐	☐	☐	☐	☐	☐	☐	☐	☐	(skive)	1/2 ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Blomkål	☐	☐	☐	☐	☐	☐	☐	☐	☐	(hode)	1/8 ☐	1/6 ☐	1/4 ☐	1/3 ☐	1/2+ ☐
Brokkoli	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/8 ☐	1/4 ☐	1/2 ☐	3/4 ☐	1+ ☐
Rosenkål	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Løk, rå og stekt	☐	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Salat (eks. issalat, ruccola)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	11/2 ☐	2 ☐	21/2+ ☐
Paprika	☐	☐	☐	☐	☐	☐	☐	☐	☐	(ring)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Avokado	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/4 ☐	1/2 ☐	3/4 ☐	1 ☐	11/2+ ☐
Tomat	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	11/2 ☐	2 ☐	21/2+ ☐
Mais	☐	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Frosne grønnsakblandinger	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐
Blandet salat (eks. salat, tomat, agurk, mais)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4 ☐	5+ ☐

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Prøv så godt du kan å gi et "gjennomsnitt" av dine spisevaner.
Ha det siste året i tankene når du fyller ut.

13. Saus og dressing

	Gang pr. måned								Mengde pr. gang					
	Aldri/ sjelden	**1**	**2**	**3**	**4**	**5-6**	**7-8**	**9+**						
Brun/hvit saus	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	½ ☐	1 ☐	1½ ☐	2 ☐	3+ ☐
Bearnéssaus, hollandés	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	½ ☐	1 ☐	1½ ☐	2 ☐	3+ ☐
Smeltet margarin/smør	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	1½ ☐	2 ☐	3+ ☐
Kryddersmør	☐	☐	☐	☐	☐	☐	☐	☐	(ts)	½ ☐	1 ☐	1½ ☐	2 ☐	3+ ☐
Majones/remulade vanlig	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Majones/remulade lett	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Seterrømme (35 % fett)	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Lettrømme (20 % fett)	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Ekstra lett rømme (10 % fett)	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Dressing (eks. Thousand Island)	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Lett dressing (eks. lett Thousand Island)	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Oljedressing, vinagrette	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Soyasaus	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Pesto	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Tomatsaus, salsa	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	1-2 ☐	3-4 ☐	5-6 ☐	7-8 ☐	9+ ☐
Ketchup	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐
Sennep	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	½ ☐	1 ☐	2 ☐	3 ☐	4+ ☐

14. Hvilken type smør/margarin/olje bruker du mest til matlaging?

Smør/margarin	Oljer
☐ Smør (meierismør)	☐ Olivenolje
☐ Bremykt	☐ Soyaolje
☐ Melange	☐ Maisolje
☐ Soft Flora, Soft Ekstra	☐ Solsikkeolje
☐ Vita	☐ Valnøttolje
☐ Soft Oliven	☐ Rapsolje
☐ Flytende margarin på flaske (Vita, Melange, Bremykt o.l.)	☐ Vita hjertego
☐ Annen margarin	☐ Andre oljer

NB:
Velg maksimalt to typer smør/margarin/olje på hele spørsmål 14.

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15. Frukt

Svar enten per måned eller per uke.

	Aldri/ sjelden	Gang pr. måned 1	2	3	eller Gang pr. uke 1	2-3	4-5	6-7	8+	Mengde pr. gang				
Eple	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Pære	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Banan	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Appelsin	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Klementiner	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4+ ☐
Grapefrukt	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Fersken, nektarin	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4+ ☐
Kiwi	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4+ ☐
Druer	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-10 ☐	11-20 ☐	21-40 ☐	41+ ☐
Melon	☐	☐	☐	☐	☐	☐	☐	☐	☐	(skive)	1 ☐	2 ☐	3 ☐	4+ ☐
Jordbær (friske, frosne)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Bringebær (friske, frosne)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Blåbær	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Multer	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Rosiner	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Tørket frukt (eks. aprikos, fiken)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-5 ☐	6-10 ☐	11-15 ☐	16+ ☐
Frukt- og nøtteblanding	☐	☐	☐	☐	☐	☐	☐	☐	☐	(neve)	1 ☐	2 ☐	3 ☐	4+ ☐

16. Grønnsaker og frukt

	Mindre enn 1	1	2	3	4	5+
Hvor mange porsjoner grønnsaker (utenom potet) spiser du vanligvis pr. dag? (En porsjon er f. eks. 1 gulrot, 1 bolle salat)	☐	☐	☐	☐	☐	☐
Hvor mange frukt spiser du vanligvis pr. dag?	☐	☐	☐	☐	☐	☐

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Prøv så godt du kan å gi et "gjennomsnitt" av dine spisevaner.
Ha det siste året i tankene når du fyller ut.

17. Desserter, kaker, godteri

Svar enten per måned eller per uke.

	Aldri/ sjelden	Gang pr. måned 1	2	3	eller Gang pr. uke 1	2-3	4-5	6-7	8+		Mengde pr. gang			
Iskrem (1 dl=1 pinne=1 kremmerhus)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Saftis/sorbet (1 dl=1 pinne)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Hermetisk frukt, fruktgrøt	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4+ ☐
Frisk fruktsalat	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4+ ☐
Pudding (eks. sjokolade, karamell)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1 ☐	2 ☐	3 ☐	4+ ☐
Vaniljesaus	☐	☐	☐	☐	☐	☐	☐	☐	☐	(dl)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Pisket krem	☐	☐	☐	☐	☐	☐	☐	☐	☐	(ss)	1 ☐	2 ☐	3 ☐	4+ ☐
Boller, julekake, kringle	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Skolebrød, skillingsbolle	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Wienerbrød, -kringle	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Muffins, formkake	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Vafler	☐	☐	☐	☐	☐	☐	☐	☐	☐	(plate)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Lefse, påsmurt	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Sjokoladekake, brownie	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Marsipankake, bløtkake	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Søt kjeks, kakekjeks (eks. Cookies, Bixit, Hob Nobs)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-2 ☐	3-4 ☐	5-6 ☐	7+ ☐
Kokosbolle	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1 ☐	2 ☐	3 ☐	4+ ☐
Sjokolade (60 g) (eks. melkesjokolade, snickers)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Mørk sjokolade (70% kakao)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(biter)	1-3 ☐	4-6 ☐	7-9 ☐	10+ ☐
Sjokoladebiter/konfekt	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-3 ☐	4-6 ☐	7-9 ☐	10+ ☐
Pastiller uten sukker	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-3 ☐	4-6 ☐	7-9 ☐	10+ ☐
Drops, pastiller, lakris, seigmenn	☐	☐	☐	☐	☐	☐	☐	☐	☐	(stk)	1-3 ☐	4-6 ☐	7-9 ☐	10+ ☐
Smågodt (1 hg = 100g)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(hg)	1/2 ☐	1 ☐	2 ☐	3+ ☐
Potetgull	☐	☐	☐	☐	☐	☐	☐	☐	☐	(neve)	1-2 ☐	3-5 ☐	6-10 ☐	11+ ☐
Annen snacks (skruer, crisp, saltstenger, lettsnacks o.l.)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(neve)	1-2 ☐	3-5 ☐	6-10 ☐	11+ ☐
Peanøtter, cashewnøtter (1 neve = 25 gram)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(neve)	1-2 ☐	3-4 ☐	5-6 ☐	7+ ☐
Mandler, hasselnøtter, valnøtter (1 neve = 25 gram)	☐	☐	☐	☐	☐	☐	☐	☐	☐	(neve)	1-2 ☐	3-4 ☐	5-6 ☐	7+ ☐

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18. Kosttilskudd (ts = teskje, bs = barneskje)

	Aldri/ sjelden	Gang pr. uke 1	2-3	4-5	6-7	Mengde pr. gang				
Tran	☐	☐	☐	☐	☐		1 ts ☐	1 bs ☐	1 ss ☐	
Trankapsler	☐	☐	☐	☐	☐	(kapsler)	1 ☐	2 ☐	3 ☐	4+ ☐
Fiskeoljekapsler, omega-3 tilskudd	☐	☐	☐	☐	☐	(kapsler)	1 ☐	2 ☐	3 ☐	4+ ☐
Seloljekapsler	☐	☐	☐	☐	☐	(kapsler)	1 ☐	2 ☐	3 ☐	4+ ☐

Multipreparater	Aldri/ sjelden	Gang pr. uke 1	2-3	4-5	6-7	Mengde pr. gang	1	2	3	4+
Sana-sol	☐	☐	☐	☐	☐	(bs)	☐	☐	☐	☐
Biovit	☐	☐	☐	☐	☐	(bs)	☐	☐	☐	☐
Mulitvitamin og mineral (eks. Vitamineral)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
Multivitaminer (uten mineraler)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐

Jernpreparater	Aldri/ sjelden	Gang pr. uke 1	2-3	4-5	6-7	Mengde pr. gang	1	2	3	4+
Duroferon Duretter, Ferromax	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
Hemofer, hemjern	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
Amino Jern	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
Jernmikstur (eks. Floradix)	☐	☐	☐	☐	☐	(bs)	☐	☐	☐	☐

Annet	Aldri/ sjelden	Gang pr. uke 1	2-3	4-5	6-7	Mengde pr. gang	1	2	3	4+
B-vitaminer (flere b-vitaminer i samme tablett)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
C-vitamin (60 mg/tablett)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
D-vitamin (10 µg/tablett)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
E-vitamin (30 mg/tablett)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐
Folat (folsyre) (200 µg/tablett)	☐	☐	☐	☐	☐	(tablett)	☐	☐	☐	☐

Annet (inkludert helsekostpreparater). Noter navn på preparatet, hvor ofte og hvor mye du tar pr. gang.

19. Måltider

Hvor ofte pleier du å spise følgende måltider i løpet av en uke? (Sett ett kryss for hvert måltid)

	Aldri/ sjelden	1 gang i uken	2 ganger i uken	3 ganger i uken	4 ganger i uken	5 ganger i uken	6 ganger i uken	Hver dag
Frokost	☐	☐	☐	☐	☐	☐	☐	☐
Formiddagsmat/lunsj	☐	☐	☐	☐	☐	☐	☐	☐
Middag	☐	☐	☐	☐	☐	☐	☐	☐
Kveldsmat	☐	☐	☐	☐	☐	☐	☐	☐

Hvor mange ganger i løpet av dagen pleier du å spise et eller annet utenom hovedmåltidene? (eks. godteri, frukt, brødskive)

Sjelden	1 gang om dagen	2 ganger om dagen	3 ganger om dagen	4 ganger om dagen	Mer enn 4 ganger om dagen
☐	☐	☐	☐	☐	☐

20. Kjønn

Mann ☐

Kvinne ☐

21. Alder

Alder: ☐☐ år

22. Vekt og høyde

Høyde: ☐☐☐ cm

Vekt: ☐☐☐ kg

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23. Eventuelle andre matvarer

Bruker du regelmessig matvarer, drikker eller andre produkter som ikke er nevnt i spørreskjemaet? Skriv ned dette så detaljert som mulig. Skriv også hvor ofte du spiser/drikker dette (ganger per måned eller uke) og hvor mye du spiser av dette per gang.

BRUK BLOKKBOKSTAVER

Tusen takk for innsatsen!

UiO : Institutt for medisinske basalfag
Det medisinske fakultet

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Appendix III: Additional questionnaire

DATO: ☐ UIO/LØPE NR:

DAG: Mandag / Tirsdag / Onsdag / Torsdag / Fredag / Lørdag / Søndag

STED (SENIORSENTER): ______________________________

1. UTDANNING

   Hvilken utdanning er den høyeste du har fullført? *(Sett bare ett kryss)*

   Mindre enn 7 års grunnskole .... ☐

   Grunnskole 7-10 år, framhaldsskole, folkehøgskole ... ☐

   Realskole, middelskole, yrkesskole,
   1-2 årig videregående skole... ☐

   Artium, økonomisk gymnas, allmennfaglig
   retning i videregående skole .... ☐

   Høgskole/universitet, mindre enn 4 år .... ☐

   Høgskole/universitet, 4 år eller mer .... ☐

2. BOFORHOLD OG FAMILIE

   2.1.Bor du i egen bolig (ikke på alders/sykehjem)? .... | Ja | | Nei |

   2.2.Bor du sammen med ektefelle/samboer? .... | Ja | | Nei |

   2.3.Har du egne barn i nærheten (f.eks. i Oslo eller Bærum)? .. | Ja | | Nei |

3. RØYKING

   Har du røykt/røyker du?.......... | Ja, nå | | Ja, tidligere | | Aldri |

4. EGEN HELSE

   Hvordan er helsen din nå? *(Sett bare ett kryss)*

Dårlig	Ikke helt god	God	Svært god
☐	☐	☐	☐

5. Har du i løpet av de siste fem årene hatt brudd i arm eller hofte? .... | Ja | | Nei |

6. MEDISINBRUK

   Hvor mange reseptbelagte medisiner bruker du per dag? *(Sett bare ett kryss)*

Ingen	1-3	4 eller flere
☐	☐	☐

7. ERNÆRING

Har du en spesiell diett
angitt av lege, ernæringsfysiolog eller annet helsepersonell?........... | Ja | | Nei |

Dersom ja, er dette på grunn av

7.1.Diabetes (sukkersyke).. | Ja | | Nei |

7.2.Hjerte og karsykdom.. | Ja | | Nei |

7.3.Sykdom og / eller operasjon i mage eller tarm............................. | Ja | | Nei |

7.4.Sykdom i nyrene .... | Ja | | Nei |

7.5.Sykdom i lungene.. | Ja | | Nei |

7.6.Annen sykdom.. | Ja | | Nei |

8. Hvordan var din opplevelse av å fylle ut spørreskjemaet om kosthold?

Veldig lett	Lett	Middels	Litt vanskelig	Vanskelig
☐	☐	☐	☐	☐

BESVARES KUN AV DE MED INNVANDRERBAKGRUNN

9. Hvor lenge har du bodd i Norge?

< 5 år	> 5 år	>10 år	Født i Norge
☐	☐	☐	☐

10. Hvilken region i verden kommer du fra opprinnelig?

Nord Afrika og Midtøsten (inkl. Tyrkia) .... ☐

Sub-Sahara Afrika... ☐

Sør-Asia.. ☐

Øst-Asia.. ☐

Latin Amerika/Karibisk.. ☐

Oseania... ☐

Nord –Amerika... ☐

Europa.. ☐

Appendix IV: Consent form

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

Næringsinntak hos hjemmeboende eldre personer i Oslo

Dette er et spørsmål til deg om å delta i et forskningsprosjekt for å kartlegge kostholdet hos hjemmeboende eldre personer. Det finnes lite informasjon om inntak av næringsstoffer fra kostholdet hos eldre personer. Vi forskere på Universitet i Oslo ønsker å få innblikk i om voksne i denne aldersgruppen har et tilstrekkelig inntak av ulike næringsstoffer som eksempelvis magnesium, kalsium, vitamin D, jern, jod og hvordan inntaket av de forskjellige matvarene er.

HVA INNEBÆRER PROSJEKTET?

Din deltakelse består av to spørreskjema. Du vil bli spurt en rekke spørsmål om det kostholdet du vanligvis har. Det er også et begrenset antall spørsmål om din bakgrunn og helseforhold, bl.a. for å kunne undersøke om personer med ulik bakgrunn har forskjellig næringsinntak. Det tar ca. 30 minutter å fylle ut skjemaene. Du kan spørre om hjelp underveis hvis det er noe du ikke forstår, og du kan også ta med deg skjemaet hjem og levere det på et senere tidspunkt.

Vi vil ikke samle inn annen informasjon om deg enn det du oppgir på skjemaene

MULIGE FORDELER OG ULEMPER

Fordelen med din deltakelse er at du bidrar med informasjon om kostholdet og næringsinntak for din aldersgruppe. Dette er viktig både for å få en oversikt over kosthold og næringsinntak hos eldre personer, og kan gi grunnlag for anbefalinger og tiltak som er særskilt rettet mot din aldersgruppe. Det er ingen risiko forbundet med å delta i undersøkelsen, men det kreves at du fyller ut spørreskjemaene.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dersom du trekker deg fra prosjektet, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte professor Haakon E Meyer, telefon 480 82 7020, e-post: h.e.meyer@medisin.uio.no eller Cecilie Dahl, telefon 228 50630, e-post: cecilie.dahl@medisin.uio.no .

HVA SKJER MED OPPLYSNINGENE OM DEG?

Opplysningene som registreres om deg skal kun brukes slik som beskrevet i hensikten med prosjektet. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene.

Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger.

Navnet ditt vil kun stå på samtykkeskjemaet, men det vil ikke bli registrert elektronisk eller koblet til de andre opplysningene.

Opplysningene om deg vil bli anonymisert ved prosjektslutt den 31.12.2023.

GODKJENNING

Norsk senter for forskningsdata har vurdert prosjektet, og har gitt forhåndsgodkjenning: referansekode 82668

Etter ny personopplysningslov har behandlingsansvarlig Universitetet i Oslo og prosjektleder Haakon E Meyer et selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag. Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel 6 nr. 1a og artikkel 9 nr. 2a og ditt samtykke.

Du har rett til å klage på behandlingen av dine opplysninger til Datatilsynet.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet kan du ta kontakt med Haakon E Meyer, telefon 480 82 7020, e-post: h.e.meyer@medisin.uio.no eller Cecilie Dahl, telefon 228 50630, e-post: cecilie.dahl@medisin.uio.no .

Personvernombud ved institusjonen er Roger Markgraf-Bye: personvernombud@uio.no

JEG SAMTYKKER TIL Å DELTA I PROSJEKTET OG TIL AT MINE PERSONOPPLYSNINGER BRUKES SLIK DET ER BESKREVET

Sted og dato | Deltakers signatur

Deltakers navn med trykte bokstaver

Appendix V: Recruitment poster Senior centers

UiO

FORSKNING PÅ NÆRINGSINNTAK HOS GODT VOKSNE I OSLO

Er du en voksen over 65 år?

Et ernæringsmessig godt kosthold er viktig å opprettholde livet ut, men vi vet altfor lite om næringsinntaket til godt voksne, hjemmeboende kvinner og menn i Oslo.

Institutt for Helse og Samfunn på Universitetet i Oslo søker derfor frivillige til en studie som skal kartlegge typiske kostholdsvaner hos voksne over 65 år.

Vi kommer til Vindern Seniorsenter
Tordag 21/11 og fredag 22/11

Det vil bli beregnet ca. 30 minutter per person for utfylling av skjemaet, hvor deltagerne har mulighet til å stille spørsmål, samt få hjelp til utfylling, hvis de ønsker det.

Denne forskningsstudien er gjennomgått og godkjent av Universitetet i Oslo og Norsk senter for forskningsdata

Appendix VI: NSD Ethical Approval

NSD NORSK SENTER FOR FORSKNINGSDATA

NSD sin vurdering

Prosjekttittel

Næringsinntak hos hjemmeboende eldre personer i Oslo

Referansenummer

826683

Registrert

01.10.2019 av Cecilie Dahl - cecida@uio.no

Behandlingsansvarlig institusjon

Universitetet i Oslo / Det medisinske fakultet / Institutt for helse og samfunn

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Haakon Meyer, Haakon E Meyer <h.e.meyer@medisin.uio.no>, tlf: 22850649

Type prosjekt

Forskerprosjekt

Prosjektperiode

14.10.2019 - 31.12.2023

Status

17.10.2019 - Vurdert

Vurdering (1)

17.10.2019 - Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet 17.10.2019 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte. MELD VESENTLIGE ENDRINGER Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde: https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html Du må vente på svar fra NSD før endringen gjennomføres. TYPE OPPLYSNINGER OG VARIGHET Prosjektet vil behandle særlige kategorier av personopplysninger om etnisitet og helseforhold og alminnelige kategorier av personopplysninger frem til 31.12.2023. LOVLIG GRUNNLAG Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 nr. 11 og art. 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse, som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes uttrykkelige samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a, jf. art. 9 nr. 2 bokstav a, jf. personopplysningsloven § 10, jf. § 9 (2). PERSONVERNPRINSIPPER NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om: - lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen - formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål - dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet - lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet DE REGISTRERTES RETTIGHETER Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20). NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13. Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned. FØLG DIN INSTITUSJONS RETNINGSLINJER NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32). For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon. OPPFØLGING AV PROSJEKTET NSD vil følge opp underveis (hvert annet år) og ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet/pågår i tråd med den behandlingen som er dokumentert. Lykke til med prosjektet! Kontaktperson hos NSD: Kajsa Amundsen Tlf. Personverntjenester: 55 58 21 17 (tast 1)